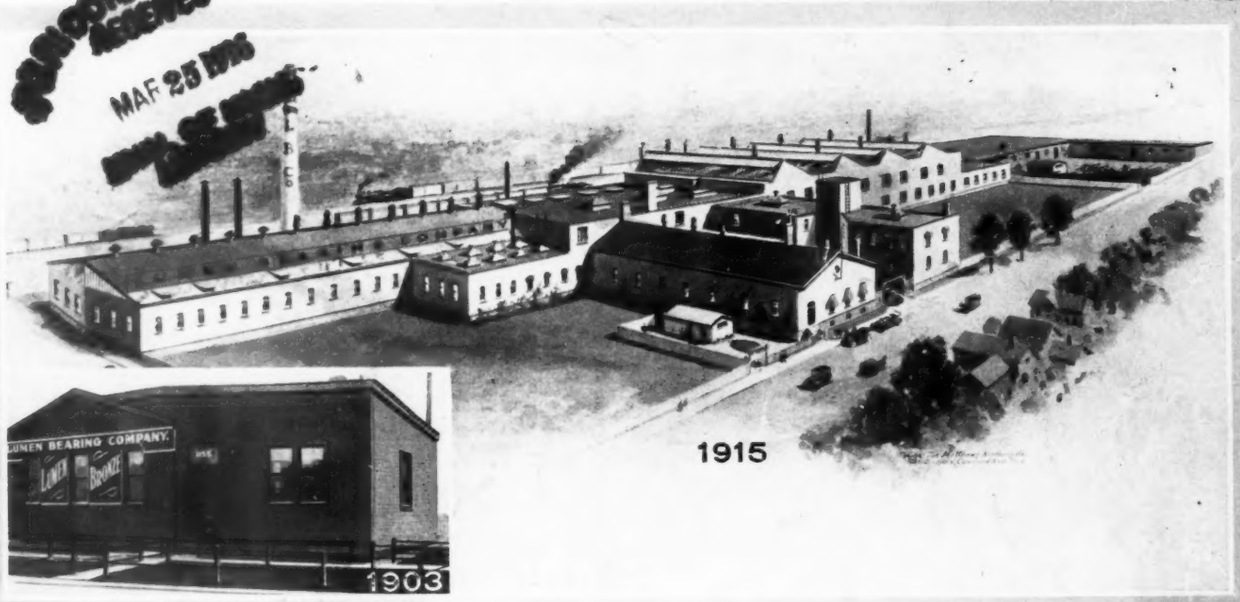
The Automobile

Vol. XXXIV, No. 12

NEW YORK, MARCH 23, 1916

Ten cents a copy
Three dollars a year

Engineering Library
PERIODICAL ROOM
MAR 25 1916



This plant has been developed to its present size by careful attention to the demand for

BETTER CASTINGS

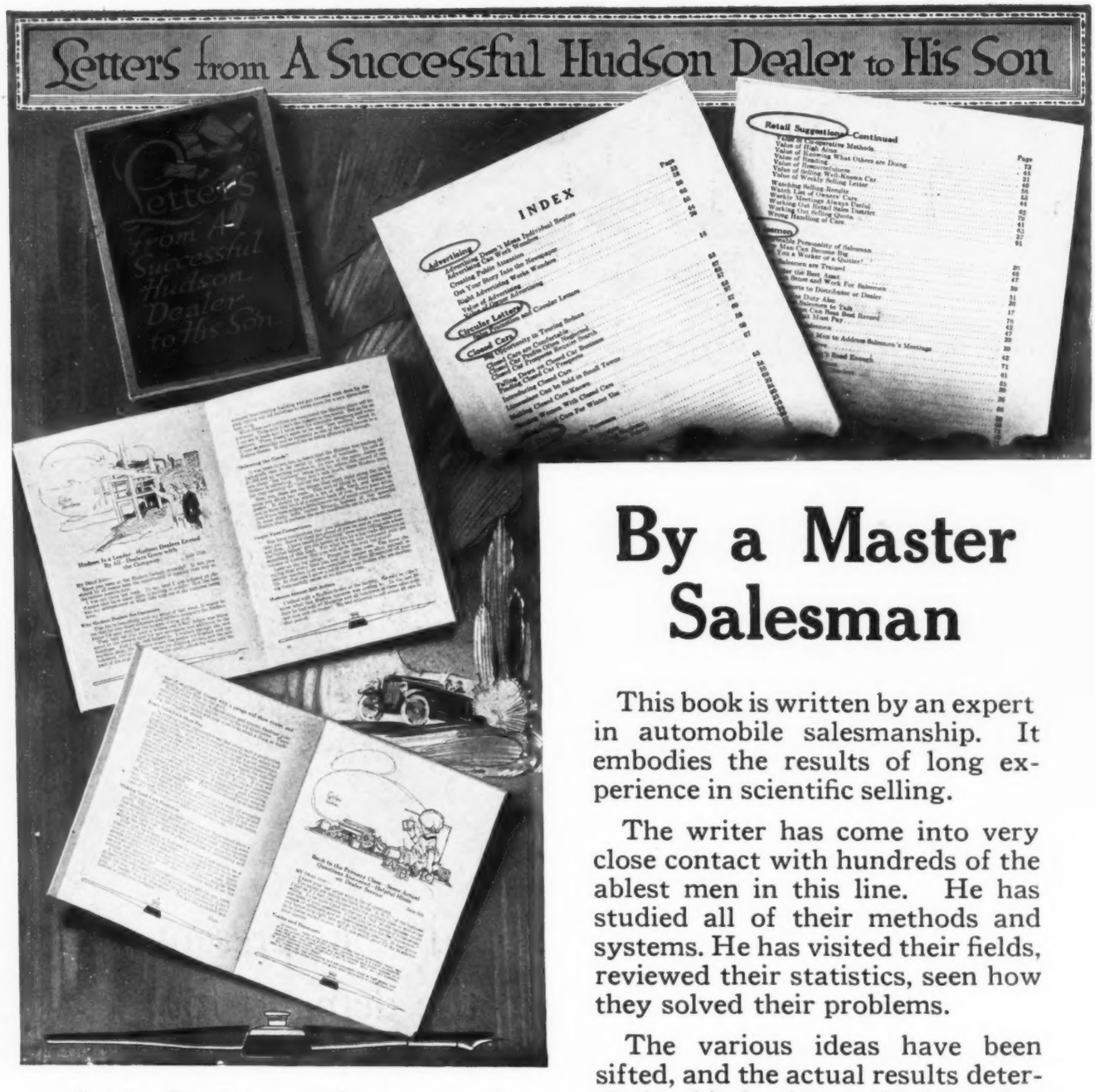
• •

GEAR BRONZE
BEARING BRONZE
MANGANESE BRONZE ·· DIE CASTINGS
BABBITTS AND SOLDERS

• •

LUMEN BEARING COMPANY

BRASS FOUNDERS
BUFFALO


Letters from A Successful Hudson Dealer to His Son
Letters From A Successful Hudson Dealer to His Son
INDEX
Retail Suggestions Continued

By a Master Salesman

This book is written by an expert in automobile salesmanship. It embodies the results of long experience in scientific selling.

The writer has come into very close contact with hundreds of the ablest men in this line. He has studied all of their methods and systems. He has visited their fields, reviewed their statistics, seen how they solved their problems.

The various ideas have been sifted, and the actual results determined. So the countless suggestions made in this book are the best that the line has developed. Not a man in this line can read this book without becoming a better salesman. And many a man can multiply his earning power by studying these suggestions.

Send 25 Cents and this book will be mailed you. It was written, of course, for Hudson salesmen and dealers. But its principles of salesmanship apply to every make of car. Also its ideas on territory, on computing possibilities, on service, on used cars, on all the problems which confront a worker in this line. The Hudson Company is very glad to share them. Send us 25 cents as evidence of interest. If you do not think the book is worth it, the amount will be returned. Mail us the coupon now.

HUDSON MOTOR CAR COMPANY, DETROIT, MICH.

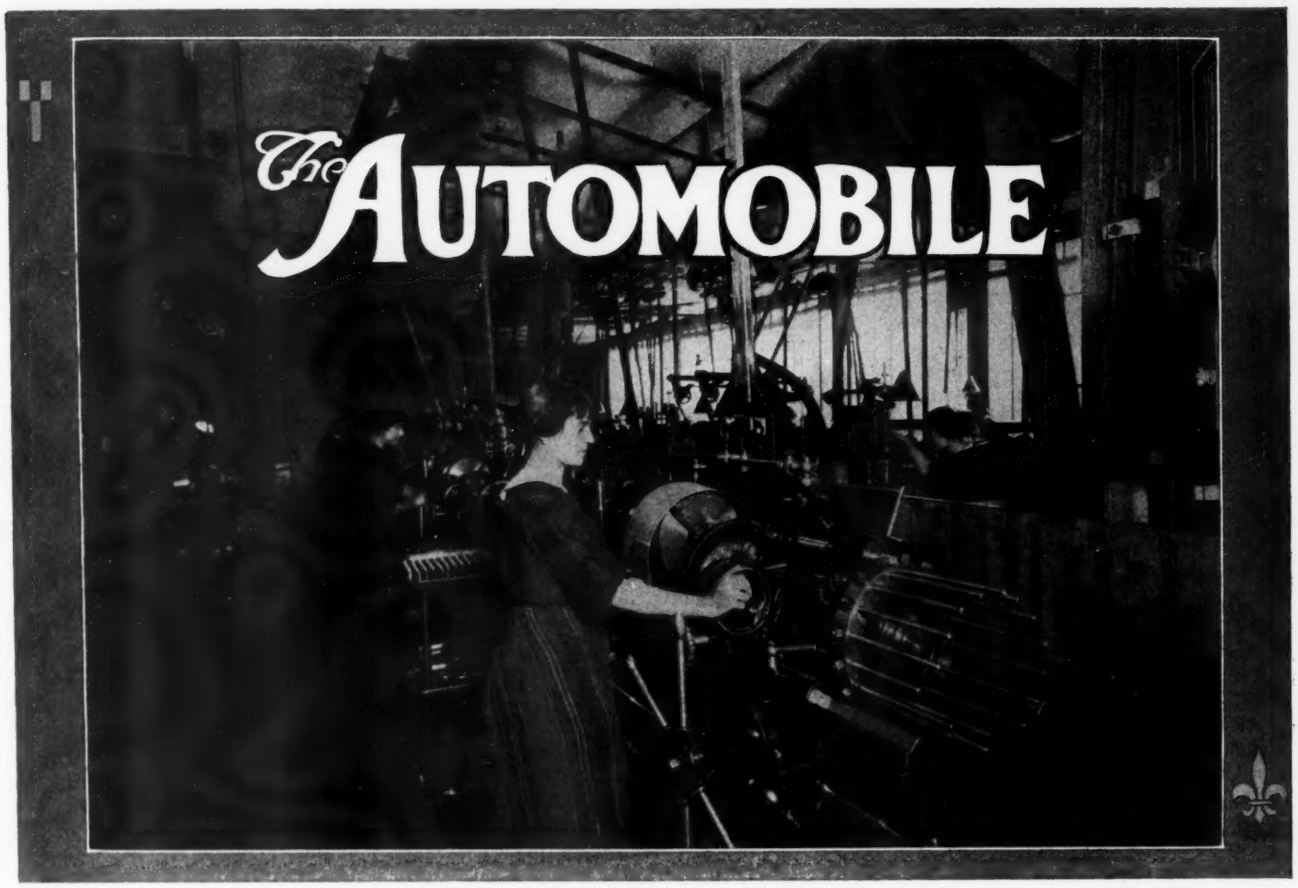
HUDSON MOTOR CAR COMPANY
Detroit, Mich.

Enclosed find 25 cents for your book on successful retail selling.

Name .....

Address .....

VOL. XXXIV NEW YORK—THURSDAY, MARCH 23, 1916—CHICAGO NO. 12



Women in Europe are finding machine shop work both patriotic and profitable

British Industry Better Equipped

Effect of War Different in Different Plants—Reorganization for Munition Making Will Aid Better Manufacturing in Peace Time—Cheaper British Cars Anticipated

ASKED how the British automobile industry stood at the present time, one of the leading manufacturers replied "There isn't any British motor industry now—that's all there is to say." It was the same maker who, asked by King George, during an official visit, how the war had affected them, replied "It has given us Hell."

In the same town, not more than a mile away, another automobile manufacturer said "come and see." And he took me through shops with not a square inch of waste space in them; he showed me women and girls making hand grenades and encouraged to maximum output by means of intelligently distributed premiums; he took a pride in pointing out a score of contrivances to simplify operations and adapt existing machinery to special munition work; he showed how, by an intelligent system, he was able to secure material and was able to keep his car section running on a reduced scale while making bigger deliveries of war material than the army had estimated his factory could produce.

Another manufacturer's leading hope was that the government would prohibit the importation of automobiles for two years after the war. A fourth was of the opinion that if England could not compete with foreign nations without protection there was something wrong with her system. He also pointed out that the American car, by coming in when the British manufacturers were unable to supply, had saved hundreds of automobile dealers from financial disaster.

These examples have been given to show the varied viewpoints of the British automobile manufacturers. Go into one factory and there is dark pessimism; go into another and it is to find buoyant optimism; in a third the outstanding feature is jealousy that a rival should have found means to keep on with a certain measure of car production; another has grasped the truth that it is necessary, first and foremost, to get through with the war, and let the future take care of itself. There is no uniformity of view; there are no indications of any national program for the future conduct of the automobile industry; there appears to be very little hope that the government will assist the industry in the critical reconstruction period which will immediately follow the war; it does not seem that any plan has been worked out by which the government could help the industry. The general impression gained after mixing with members of the English automobile industry is that the British car manufacturer does not realize his own strength. He has accepted war conditions according

to his particular temperament; he is going through to the end, whatever the end may be; but he has not yet had time or sufficient imagination to lay out possible plans.

All Factories State Controlled

Practically the whole of the English automobile factories are state controlled establishments. The exceptions are some of the smaller factories which, while undertaking a cer-amount of military work, are also continuing the production of cars or other components in which they are normally interested. The amount of such work being done for private owners bears a very small porportion to the whole, and is not worth the indignation, or jealousy, as the case may be, of those manufacturers who have been absorbed entirely by the war machine. In this connection, there is no ground for a suspicion that some English makers appear to have, which is that the French factories are doing more private business than they. The English are doing little for the civilian client; the French are doing less.

Conditions Vary Widely

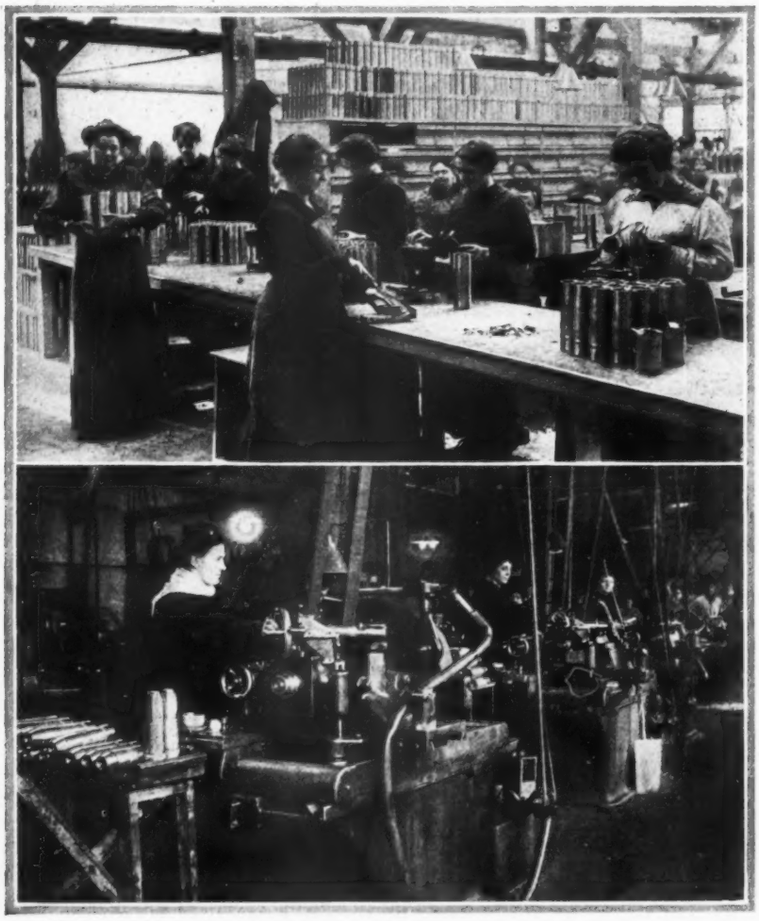
Factories under government control are not necessarily prevented from making automobiles; but they are prevented from doing other than government work, except under special circumstances and with special permission. There are shops in which hardly a shell is to be seen, the entire plant and all hands being employed on trucks, touring cars and aviation motors for the army. In others not a single machine is running on automobile parts. The former have a certain advantage over the latter, for they are keeping their staffs on the usual work, they are gaining experience with war models, and that experience can be put to good use when peace conditions are re-established. It appears to be one of the chances of war whether a factory shall be kept on trucks and cars or on shells.

The fact is obvious, merely from an examination of the English automobile factories, that there has not been the single national control of the industry which is such a distinctive feature of the continental industry. A few of the big factories were switched from civilian car work to the production of military automobiles within a week of the outbreak of war and have from that time to the present date been employed exclusively and ever-increasingly on war material. Other and smaller manufacturers state that for months they tried to get war contracts for either automobiles or munitions and failed to obtain any satisfaction from the authorities. Finally they were able to get sub-contracts from the big contractors.

Half-Finished Cars

Many of these factories now running two shifts on war munitions were doing practically nothing when Asquith made his famous "no shell shortage" speech. Other cases are to be found where factories tried to carry on their ordinary production, building for stock under the impression that the war would be short and that there would be a big demand for cars at its close. Several of such factories were suddenly ordered to accept contracts for shells and other military material, and work on cars had to be stopped at practically a moment's notice. This is shown by the large stocks of partly finished material—frames, cylinders, gearboxes, axles, motor units, etc.,—sometimes piled up nearly as high as the roof. Control is so close that even the little labor necessary to transform some of these units into complete cars cannot be obtained.

In these shops it will be an easy matter to resume work on automobiles without loss of time as soon as military restrictions are withdrawn. Obviously however, the pre-war models will have to be continued for a certain length of time.

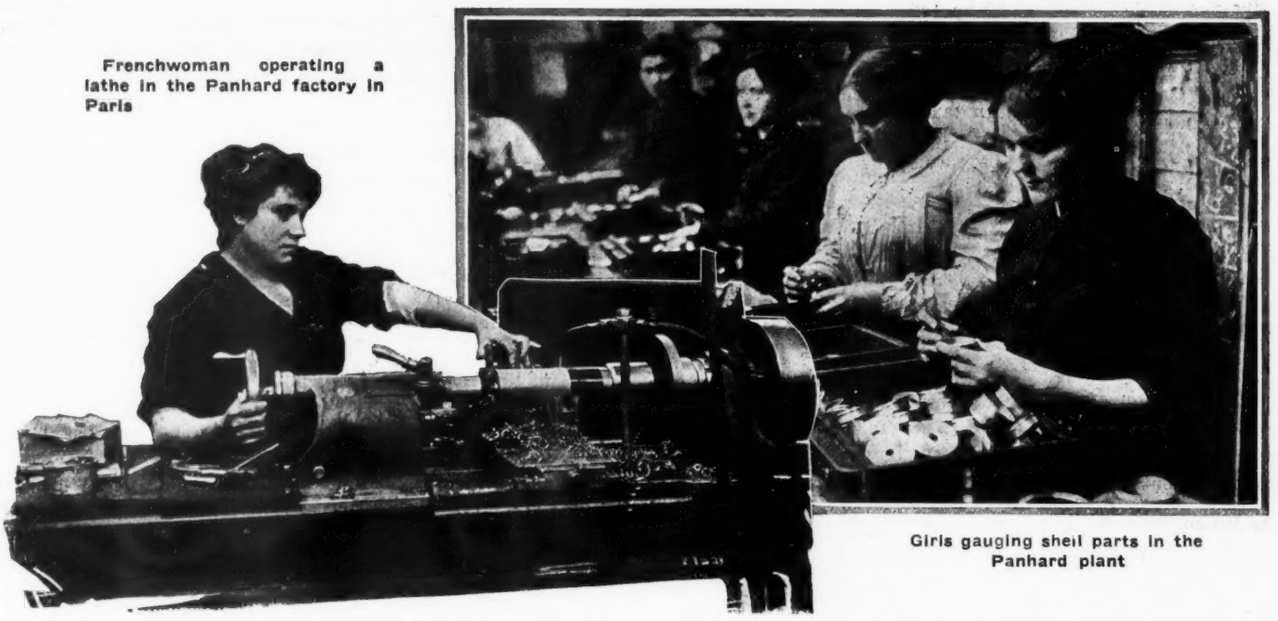


Making and loading shells in a factory where high grade passenger cars are the stock product

Engineering Activity at Maximum

Although there is still room for extension in some of the automobile factories, the engineering industry as a whole appears to be getting very near its maximum output. One authority states that the limiting factor now is the world's production of steel. He claims that the amount of steel used for shell making at the present time is equal to the total world's output before the war. As an instance of the world-wide influence of the war on the metal industry, Japan is now supplying some English factories with brass bars.

The work done during the past twelve months is nothing less than stupendous. In this connection it is necessary to avoid anything like precise statements, for obvious reasons. As instances of activity, I was shown one factory employing 2500 Belgians—men and women—running two shifts and working six and one-half days a week, producing 3500 shells a day, having six hydraulic presses which would go into service within a week and increase the output 100 per cent, and possessing a laboratory and test department equal to those of the best engineering establishments to be found in any part of the world. Where this modern, highly efficient, and well organized factory now stands, there was but one year before an uncultivated field without a brick on it. It was not only necessary to plan, build, and equip that factory,



Frenchwoman operating a lathe in the Panhard factory in Paris

Girls gauging shell parts in the Panhard plant

but to bring together and find accommodation for the workpeople and their families, numbering about 4000 people, most of whom did not speak a word of English.

In another town a French automobile company had opened an English factory and had trained 300 mechanics to the highest class of work in which no tolerance whatsoever is allowed. All finished parts have to be dead accurate. While this work is going on in the temporary factory, a bigger factory for 1000 workpeople is being erected, the builders being under a penalty of $500 per day for late delivery. In addition to this factory, the same company has completed a new factory in the south of France and has doubled the size of its original factory. Practically all the automobile factories of the Midlands are extending, building operations going on both day and night by the aid of special electric lights.

Women Do Good Work

Increased output has only been made possible by a considerable dilution of skilled labor and the introduction of women on work to which they were originally entire strangers. This change is less evident in the automobile than in the national ammunition factories. Nevertheless women are now an important factor even in the automobile shops and they have been responsible for a considerable amount of speeding-up. It is found an easy matter to train a woman to get the maximum out of a machine, and this has had its influence on men who have systematically kept machines below their maximum output.

The change in the internal organization of the factories has not been possible without some friction. There have been strikes in certain districts, and there are a few labor disturbances at the present moment. But so far as the British automobile industry is concerned, it has not been found possible to discover a single case of a strike, and where there have been dissensions they have always been settled amicably by a straight talk between employers and workpeople.

As an indication of the spirit of the workpeople in the automobile industry, one man in a factory of 2000 workers refused to join up under the Derby recruiting scheme. He was roped into a wheelbarrow and taken by force through the streets of Coventry to the recruiting station. In another factory in the same town 500 men threatened to down tools if a Colonial, who had refused to recognize the recruiting scheme, was not dismissed. The man was obliged to leave without waiting for a dismissal from the firm, and could not gain employement elsewhere in the town.

Joining the army under the group scheme does not make any material change to the majority of the men in the automobile factories, for they are in reserved occupations and are considerably more use to the army as mechanics than as soldiers. The fact remains, however, that by joining the groups they put themselves under military law and could be drawn from their present occupations and put into the army if it became necessary to do so for any reason. The manner in which Briand stopped the railroad strike in France a few years ago by putting the strikers under military law is an example of the force of this weapon.

Wages Are Raised

There has been a general increase in wages, but this has not attained the proportions stated in many quarters. From close inquiries it is found that wages in the automobile industry have risen 25 per cent on an average. At the same time food prices have increased 30 per cent. As this increase does not apply to more than one-half of the worker's necessary expenditure, the net result is to his advantage. Stories of youths earning $25 to $30 a week are nearly always found to be based on some special week when accumulated bonuses were paid. In some of the automobile body-building factories expert workers on piece rates are drawing $25 a week for aeroplane propeller construction, but this is above the average even in this particular branch. The general condition of working families in the automobile trade is better than at any previous time, for whereas before the war only one member worked, now three to four members can find employment with a minimum wage of $5 a week for girls.

Experimental Work Progresses

Although very little publicity is given to the fact, experimental work is still being carired on to a limited extent, in the best English factories. In addition, the best arrangements possible are being made to return to the usual class of work as soon as release is obtained from army contracts. On the whole the English factories are better placed in this respect than are the French. In England production was stopped suddenly and no attempt made to use up the series in course of construction. In France manufacturers gradually exhausted their stocks and only ceased building cars when they had nothing more to build them with.

Not much information is allowed to get out regarding the contemplated after-the-war models. It is certain, however, that there will be a decided increase in the number of medium priced cars and in small light two-seaters with four-cylin-

der motors 60 by 110 to 70 by 140 mm. bore and stroke. It is believed that whatever the outcome of the war strict economy will be exercised for a number of years and that there will be no demand for big cars which will be costly to maintain on account of high taxation, high cost of fuel and tires. At the present time there are important factories with a reputation for the best work and an experience in big cars only, now decided on the production of big series of 10 hp. two-seaters. These are four-cylinder models with a cylinder bore of 70 mm. maximum. Other firms, hitherto connected with a couple of models, one of them of 10 and the other of 14-16 hp., have decided to drop the bigger type and devote themselves after the war to the 10-hp. type.

No Expensive Cars Wanted

The position of firms producing costly models only is not looked upon as particularly bright for the period immediately after the war. It is known, indeed, that one of these firms is contemplating the construction of automobile trucks, a class of work to which it has never previously paid any attention. At the end of the war several thousand big cars, varying from 16 to 30 hp. will be turned on the second-hand market, and these are bound to have a disturbing influence on the higher class of car trade. A few twin sixes are under consideration, but it is rather significant that the only firm which is at present certain to produce a twelve-cylinder car is making arrangements for the bulk of its output to be 10 hp. 2 and 4-seated light cars. Considerable experience in twin sixes is being gained on aviation work, with the possibility of some really good automobile motors with this number of cylinders.

Whether prices will be cut after the war depends largely on the cost of raw material. Assuming that material can be obtained at the same price as previous to the war, prices will certainly drop, better organization, more modern plants and a general speeding up all tending to make this possible. Several instances could be given of new factories built exclusively for war orders, which will show a profit and have the initial cost of the plant completely wiped out if the war comes to a close a year from this date.

Magneto Business Problematical

The British motor industry never has had to face important competition from Germany and is likely to have less after the war. Public opinion is alone quite sufficient to prevent the sale in England or her colonies of the leading German cars. The situation is not the same with regard to magnetos. In 1913 Great Britain imported magnetos to the value of $100,000, and of this amount Germany was responsible for $95,000. Austria sent practically none, the small remaining surplus coming from France. Since then conditions have changed, all the imported magnetos coming from America. A few of the English electrical firms have taken up magneto construction, the most important development being the Thompson-Bennett Co., Birmingham, which is an auxiliary of the powerful Lucas company. There is a hesitancy about putting money into the magneto business until definite guarantees are given of a protective tariff for a minimum number of years. The Government Commission appointed to inquire into this question has proposed a 33 1/3 per cent duty on all foreign-made magnetos. If this is adopted, and there is little reason why it should not be put into effect, there are no indications in England or anywhere in Europe, that the use of the magneto will be lessened by reason of the present situation. Electric lighting and starting will be found on all European after-the-war models, but this is not likely to supplant the separate magneto for ignition purposes.

Eight Firms Make Aero Engines

The bulk of the aeroplane motor construction is in the hands of eight automobile firms, of which five are building V-motors and the three others various types including V's. Although every type of motor is in use, including Gnomes, eight-cylinder air-cooled, eight-cylinder water-cooled, six-cylinder vertical water-cooled, and twelve-cylinder water-cooled, the tendency is towards the V water-cooled motor with eight or twelve cylinders. Power is increasing, the opinion holding that comparatively few motors will be produced of less than 200 hp.

For hydro-aeroplane work numbers of twelve-cylinder motors developing 300 hp. and more are being produced. The most important of these is a twelve-cylinder of 100 by 160 mm. bore and stroke. This change from 75 to 80 hp. motors running at 1200 r.p.m. to motors of 100, 150, 200, and even more than 300 hp., running at 2000 r.p.m., and having a geared-down propeller, is one of the most important developments in connection with the automobile industry.

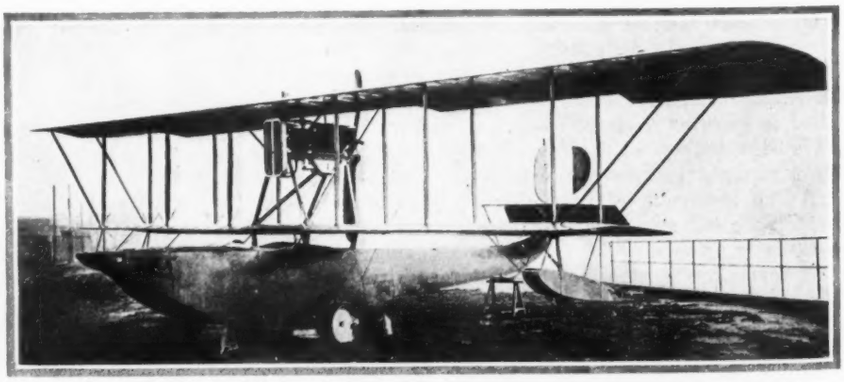
This movement is not confined to the British, but is general throughout the Allied countries. In France, Peugeot and other factories working in conjunction with them are producing thousands of eight-cylinder V-motors, the direct outcome of racing practice. In England the twelve-cylinder Sunbeams for aviation work have only been made possible by reason of racing experience.

While there is very little use of aluminum alloy pistons to be found on the Continent, the leading English firm uses aluminum-alloy exclusively. It is understood that this firm has spent $10,000 on experiments and has produced an aluminum nickel alloy piston which is perfect and can be used with the same clearances as an all-steel piston.

Hispano-Suiza Aluminum Engine

The aviation motor which is attracting the greatest amount of attention is the eight-cylinder Hispano-Suiza now being built in England. This motor is probably the first aluminum cylinder engine to be built in any quantities. It was first produced more than a year ago at the Barcelona factory of the Hispano-Siuza company and brought before the French authorities, who have decided to adopt it and had it built in the main factory of this company at Paris. It has since been taken up under license by other firms in France and more recently has been secured by the British government.

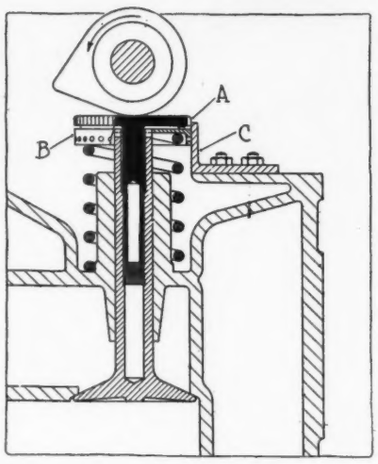
This motor has its cylinders cast in groups of four with steel liners inserted. A detachable cast-iron head carries the valves—two per cylinder—and the overhead camshaft is driven by bevel gearing and a vertical shaft at the front end of the motor. One of the patented features of this motor



An Hispano-Suiza hydro-aeroplane which has an eight cylinder aluminum engine with a special valve mechanism

is the direct operation of the cams on the valve stems, without any intermediate mechanism. The general principle is shown in the illustration. There is a separate carbureter for each group of cylinders and lubrication is under high pressure to all parts, with the oil passing through a radiator.

The valve stem is hollow and has an adjustable tappet screwed into its open end. The upper end of the tappet rod carries a disc which is slotted on its edge and formed with teeth on its under side. Beneath this disc there is a second disc which is threaded on to the tappet rod, so that the rod can turn in it, but this second disc is keyed on to the valve spindle by two lugs formed on the end of the spindle. The second disc also has teeth formed on its upper face to engage the teeth on the first disc, and the two are held in engagement by a spring.



Details of the valve tappet adjustment used on the Hispano-Suizer aluminum aeroplane engine. It gives quick adjustment and is light in weight

Adjustment is effected by screwing the tappet rod up or down in the valve spindle, and it is locked once it has been adjusted by the inter-engaging teeth on the two discs, for the lower disc cannot rotate relatively to the valve spindle. The adjustment is effected by a double toothed wrench, one tooth being engaged with circumferential holes in the lower disc and the other tooth being engaged with the slots in the edge of the upper disc so that turning one of the wrenches causes a slight relative movement of the discs.

This motor drives the propeller through spur reducing gears. With a bore and stroke of 4¾ by 5⅛ in. the motor weighs 363 lb. when equipped with two magnetos and a duplex carbureter. Cooling water is not included in this weight. Fuel consumption is 11 gal. of gasoline and 1 gal. of oil per hour. Horsepower is 200.

Official aeroplane motor tests are now very severe. The French authorities demand 50 hours' constant running, half of this at three-quarter power and half at full power. The British put all motors through a 100 hours' test before accepting and in the case of big units make them run at the end of 100 hours with the propeller out of balance for a short time.

Rushing Trucks to Mexico

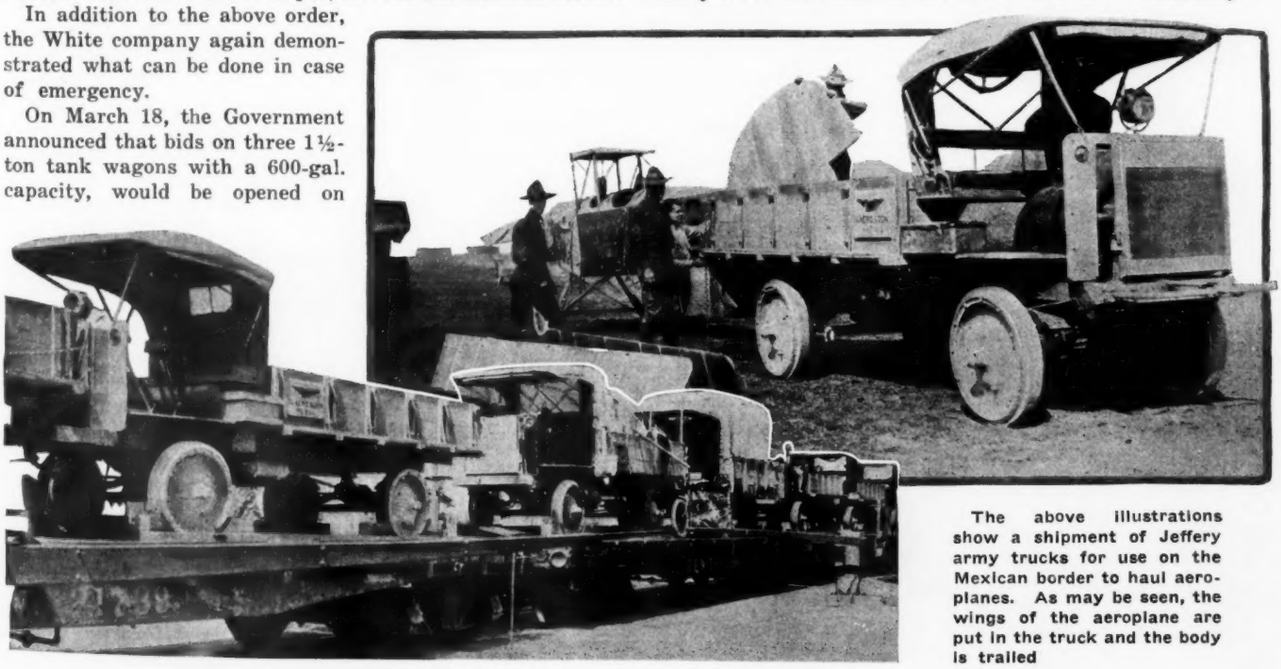
THE speed with which American truck companies can be mobilized to supply the sudden needs of the United States army was demonstrated this week when a long distance call from the War Department to the White Co. resulted in the dispatching of a special trainload of White army escort trucks to the Mexican border within 24 hr. after the order was placed.

Bids were opened at 10 o'clock on Tuesday morning and by 5.30 that afternoon the order was sent to the factory for twenty-seven chassis and one truck, which left 6 o'clock Wednesday morning. On Thursday morning the bodies and parts for these trucks were shipped, and that evening the entire personnel of White Truck Co. No. 1, consisting of one truck master, three assistant truck masters, twenty-eight chauffeurs, one mechanic and a helper, left for the Mexican border.

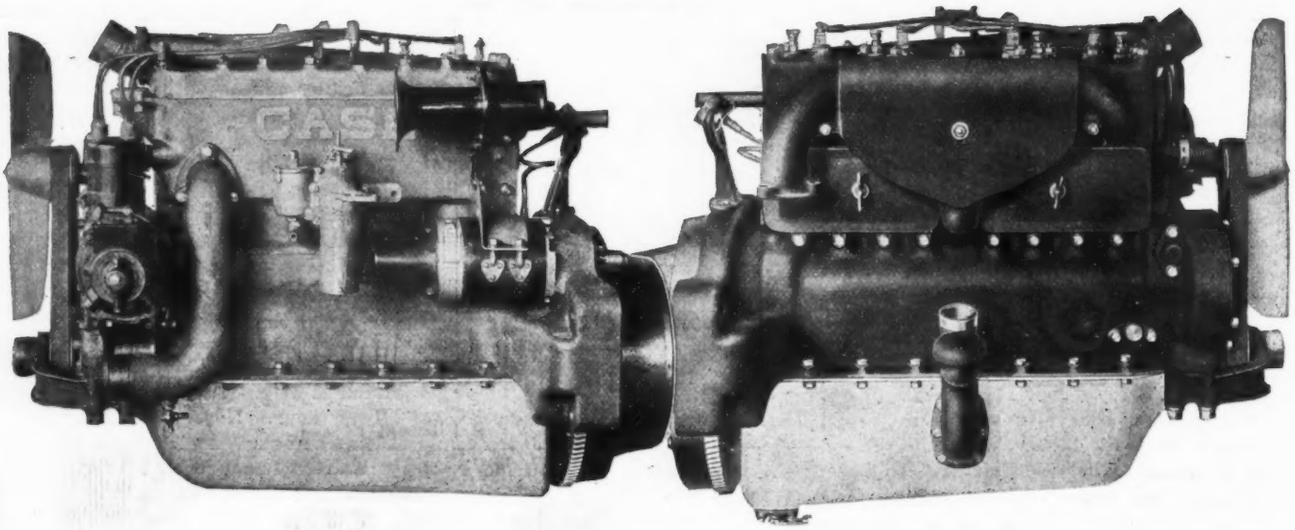
In addition to the above order, the White company again demonstrated what can be done in case of emergency.

On March 18, the Government announced that bids on three 1½-ton tank wagons with a 600-gal. capacity, would be opened on March 20. In between those two days, the White company found out that the Standard Oil Co. of New York had recently installed three of these tanks on White trucks, and immediately got into communication with them. As the Standard Oil Co. was willing to help out, the War Department was told that immediate delivery could be made on the order, which was accepted.

The Thomas B. Jeffery Co., which also figured prominently in the War Department order for twenty-seven trucks, received its order at 5 o'clock Tuesday night, March 16. At that time the workmen in the factory were leaving for home, but the Jeffery officials called them back, the order being rushed through that night. The trucks were in the freight cars at 7 o'clock Wednesday evening. The full equipment of thirty-three men was on the train at 2 a. m. Thursday.



The above illustrations show a shipment of Jeffery army trucks for use on the Mexican border to haul aeroplanes. As may be seen, the wings of the aeroplane are put in the truck and the body is trailed



Accessibility Features Case Forty

Compact Power Plant Gives 40 Hp. at 2100 r.p.m.—Uses Detachable Cylinder Head, Integral Crankcase and Unit Construction—Test Shows Easy Suspension and Flexibility

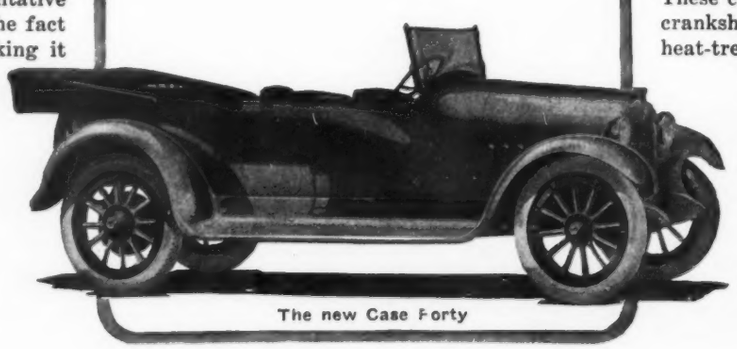
DESIGNED especially to appeal to those who believe in a four-cylinder car, the Case Forty has been put out with the idea of incorporating the essentials of careful workmanship necessary to make this vehicle compete with the lower priced sixes. Selling at $1,090 the Case Forty, as will be noted, is in a price field which is almost as thickly populated by six and more cylinder cars as it is by fours, and consequently in a study of the design it will be seen that the flexibility and power demanded at this price have been attained in the four-cylinder motor. Throughout the design is of a rugged character.

The car itself is large and roomy, having capacity for seven passengers and a wheelbase of 120 in. A test of its riding qualities shows it to be exceptionally well sprung and also to be capable of the speed demands of practically any tourist. On intermediate gear the motor propelled the car at 32 m.p.h. without any troublesome vibration and on high gear a speed of over 60 m.p.h. should readily be attained, although on the test run this was not done by THE AUTOMOBILE representative owing to traffic laws and the fact that the car was new making it undesirable to operate at the highest speed.

The manufacturers rate the engine as having from 40 to 45 brake horsepower at a speed of 2100 r.p.m. The four cylinders are cast in a single block and have 3⅝ bore by 6-in. stroke. The casting work is thoroughly up to date, the power plant being a unit with the gearset and the cylinders integral with the crankcase. In working out the suspension of the motor the front support is made up of a yoke with a ball and socket bearing in the front frame crossmember. This is the flexible point, the rigid attachments being by means of arms at the rear of the engine, bolted to the frame by a bracket which carries the transmission case.

In working out the design of the cylinders the trend toward detachable cylinder head has been followed, thus making removal of the valves an easy matter and also facilitating the removal of carbon from the combustion space and from the tops of the pistons. Close-grained gray iron is the material employed for the latter, which are fairly light.

Brake horsepower between 40 and 45
Detachable L-head block cast motor
Silent chain camshaft is adjustable
Magnetic pinion starter engagement
Pedal compensates for clutch wear



The new Case Forty

The bearings throughout the motor are of S. A. E. specification babbitt, with bronze backing. The main crankshaft, connecting-rod and gearset bearings are provided with brass laminated shims, and the three main bearings all have the same diameter of 1¾ in. The lengths of the three main bearings are respectively, from front to rear, 3⅜, 2½ and 3¾ in. These carry the high-carbon steel crankshaft which is forged and heat-treated in the Case shops. The finished grind brings the crankshaft to 1¾ in. in diameter. The piston pins are carried on bronze bushings which are inserted directly in the piston boss, and each piston is provided with three Wasson piston rings.

Drop-forged I-beam connecting-rods made,

with the rest of the engine, directly in the Case shops are employed. These are of chrome-nickel steel heat-treated to secure the greatest possible strength. The bottom bearing is held in place by four bolts, which are also of chrome-nickel steel.

Uses Chain Camshaft Drive

A feature of interest is the care in which the valve drive mechanism has been worked out. The camshaft is driven from the crankshaft by a Morse silent chain and the sprocket on the camshaft is provided with an adjustable hub for changing the timing. The camshaft itself is drop-forged, having the cams and pump eccentric integral parts of the forging. It is supported by three plain, removable bearings and is ground to a final finish. The valves are operated from this shaft through roller type cam followers operated in removable die-cast bushings. The lifters have the standard adjusing feature and the valves are of the regular mushroom type made of 3½ per cent solid nickel steel. The valve diameter is 1⅝ in. with a lift of ⅜ in.

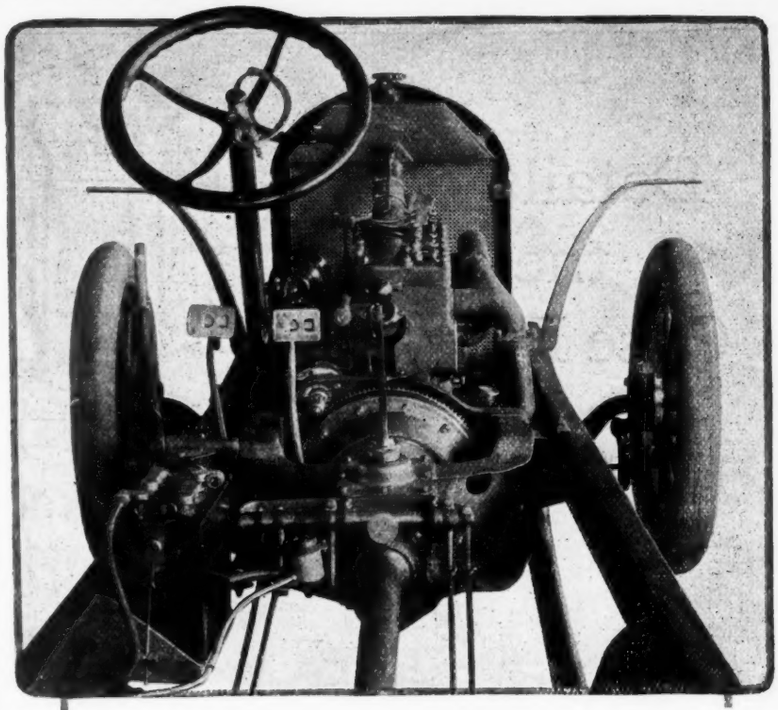
Lubrication is a combined force feed and splash system. The oil is forced to the crankshaft and camshaft bearings and splashed to the piston pins and cylinder walls. The oil pan is of pressed steel and has a 3-gal. capacity, and as already stated, the pump for circulating the oil is a plunger operated from the camshaft by an eccentric. Flow through the leads can be varied by means of an adjustable pressure release, and a pressure gage is provided on the dash which shows, at all times, the pressure under which the system is operating, while there is also a dial depth gage which shows the amount of oil in the crankcase. The leads run directly to the crankshaft and camshaft bearings and the overflow maintains a constant level in the splash troughs, insuring a supply of oil regardless of whether the car is operating on an upward or downward slope.

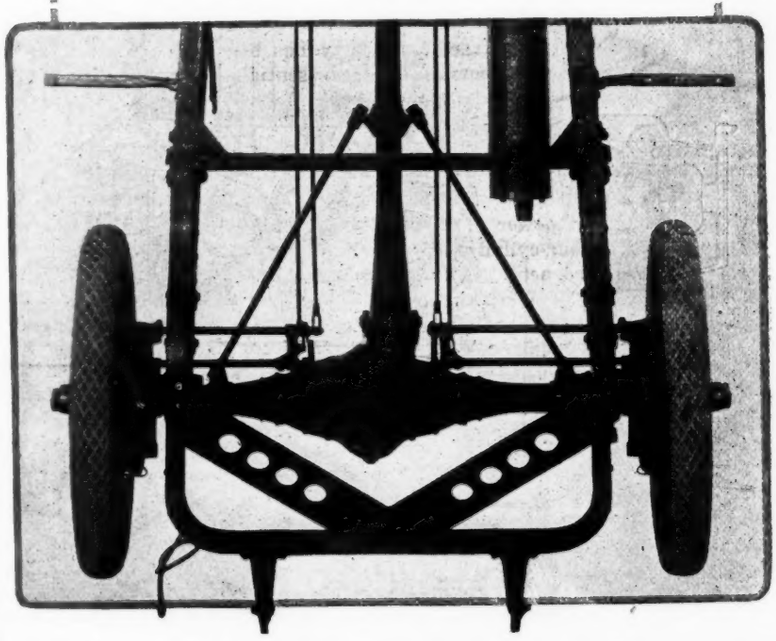
The cooling system is of standard thermo-syphon design. The radiator is a cellular type of bronze and a notable feature of its construction is that the ordinary soldered joints are not employed, the various members being sealed together instead; giving a core which is more in the form of a casting than of a made joint. The fan is two bladed and of the type commonly known as aeroplane design. It is made of cast aluminum and is equipped with a spring tightener which maintains a constant tension on the belt.

The carbureting and gasoline system is made up of a gravity feed from a cowl tank having a capacity of 14 gal. The carbureter itself is of special Case design and is equipped with a dash adjustment so that variations may be made for temperature and road conditions.

Has Magnetic Pinion Shift

Electrically, the entire car is Westinghouse, ignition, starting and lighting all being provided by this concern. The Westinghouse high-tension distributer is mounted directly on the generator by means of a vertical shaft. It includes the reversing switch feature, by means of which the polarity of the contact points in the breaker mechanism is changed frequently, thereby avoiding the possibility of building up the contact points and the subsequent seizing or irregularity in firing action.



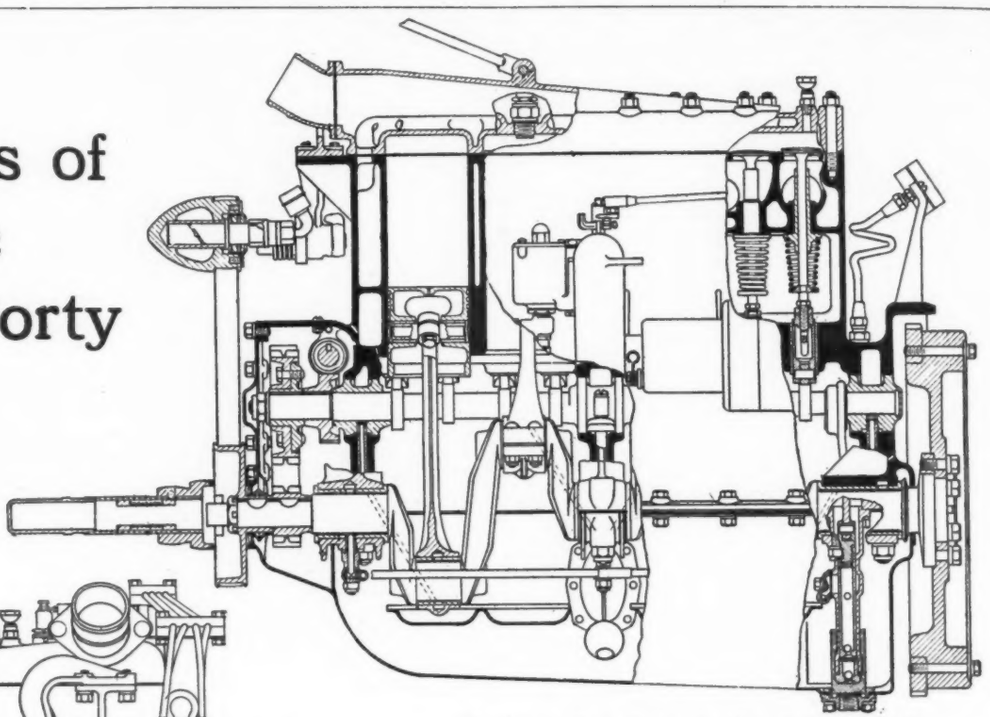


The Case Forty has a very substantial member around the flywheel and supporting the gearbox. The rear end of the frame is braced stiffly, as is the torque tube.

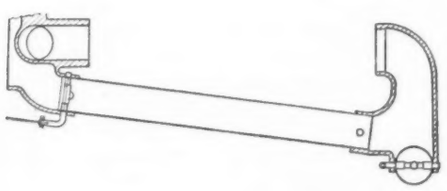
In the starting system contact is made by a magnetically-engaged pinion which meshes with the steel ring gear bolted to the flywheel. This system, as well as the ignition and lighting outfit, operates at 6 volts. The Westinghouse generator is operated at engine speed and has automatic voltage regulation. It is driven by spiral gears from the crankshaft.

The possibilities of adjustment in the clutch have not been overlooked in the Case Forty design. The pedal has an adjustment to allow for wear, and the clutch spring is provided with means of adjustment to increase or decrease the tension as desired. The cone slides on a splined shaft and the front end of this shaft is carried by an annular ball bearing in the flywheel, which also takes up the spring thrust and

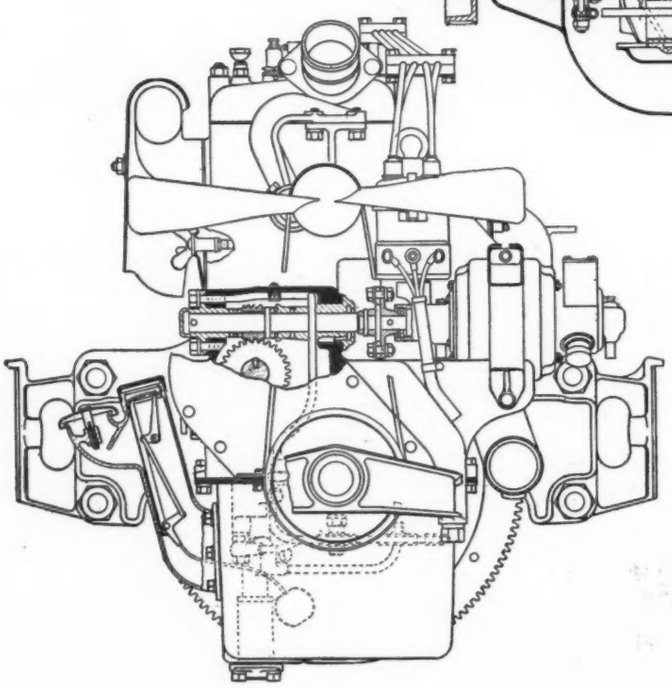
Details of the Case Forty

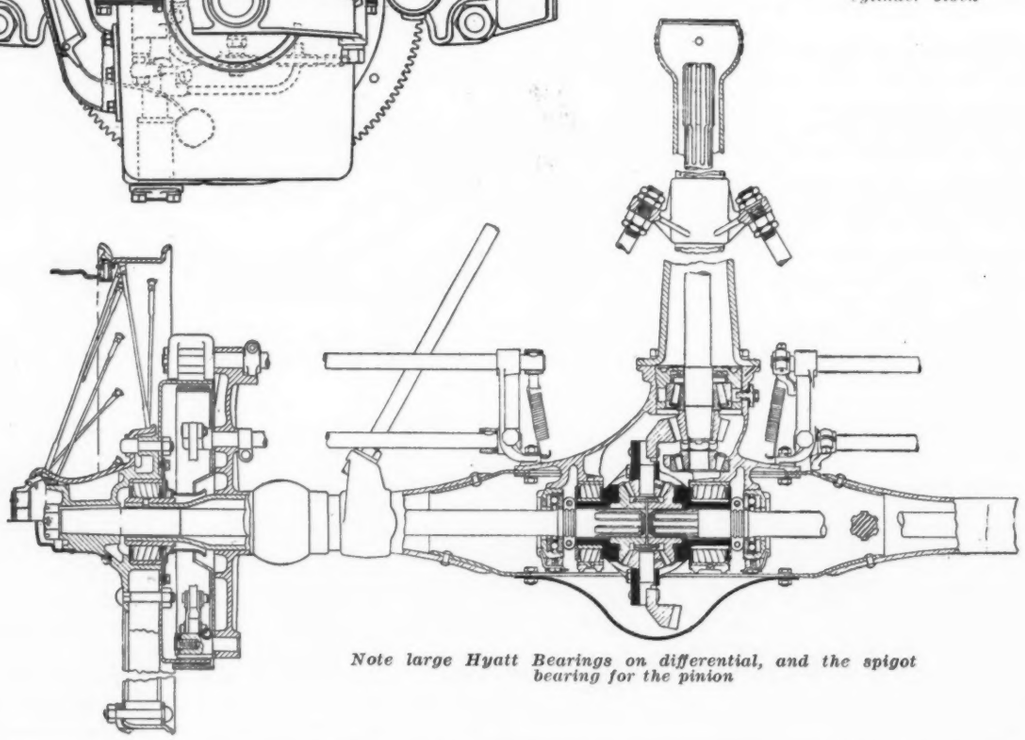


Engine of Case Forty showing chain camshaft drive and cross-shaft for magneto



Special hot air pipe used to cross cylinder block





Note large Hyatt Bearings on differential, and the spigot bearing for the pinion

prevents it from being exerted endwise on the crankshaft of the engine. Another point of adjustment is on the clutch brake, which can be so arranged as to stop the travel of the disengaged clutch at any point and with any rapidity desired.

Transmission of Standard Type

From the clutch the drive is delivered to the three-speed selective gearbox, which is arranged to carry the shifter lever in position for center control. This gearbox is a fairly well standardized design, employing Timken bearings and using 3½ per cent nickel steel gears and shafts. Back of the gearbox is a Splicer universal joint connecting the gearset shaft with the main driveshaft. This in turn transmits the drive to a Weston-Mott three-quarter floating spiral bevel rear axle.

Substantial Torque Tube

On the drive layout both the torque and drive thrust are transmitted to the rear end of the gearset housing through a torque tube which is connected with the housing by a ball and socket joint. The drive pinion shaft runs upon two Bock roller bearings, the reduction in the rear axle being 4.23 to 1.

An inverted Elliot type front axle is used, this being of I-beam section, designed and built by the Case company. I-beam section is also used for the steering arms and the steering knuckles and king pins are of special chrome-nickel steel forgings, heat-treated and machined in the Case shops.

Timken bearings are used in the front axle and the steering gear is manufactured by the Jackson, Church, Wilcox Co., under the trade name of Jacox. It is a worm and split nut design and is operated by an 18-in. corrugated wood steering wheel which has the spark and throttle levers on top with the horn button in the center.

Frame Is Extra Deep

The frame is of rather deep section, the greatest depth being at the center, where it is 6-in. At this point the spring hanger for the cantilever rear suspension is attached. This spring is 50-in. long and 2½ in. wide, and a feature is made of the special analysis steel of which this is composed, the makers claiming that the design of the spring is such that the master leaf is the last to break. The spring is carried on phosphor bronze bushings and follows the line of the frame, the main support for the spring being directly underneath the frame, doing away with any overhanging support.

The attachment to the rear axle is by universal joint, which takes up the side play and allows the spring to attain the maximum flexibility without being hampered by a fixed joint at the rear. The front spring is semi-elliptic, 37 in. long, and also said to be of a design which renders the master leaf or main plate the last to break.

Two sets of brakes, internal and external, operating on 14-in. drums are used. These bolt to the wood wheels, which are equipped with Goodyear detachable demountable rims. The tires are 34 by 4, the makers providing non-skid treads on the rear, and if desired the 35 by 4½ oversize tire can be put upon this same rim.

An all-steel body with divided front seats, adjustable back and forth, is provided and the upholstery is removable, made of grained patent leather. The standard finish of the car is Brewster green with ivory stripe and all the wiring between the body and chassis is brought to one seven-point connector-plug, which enables the body to be detached from the chassis without disturbing the wiring. There are two auxiliary seats which fold back against the sides of the body and are always accessible for service.

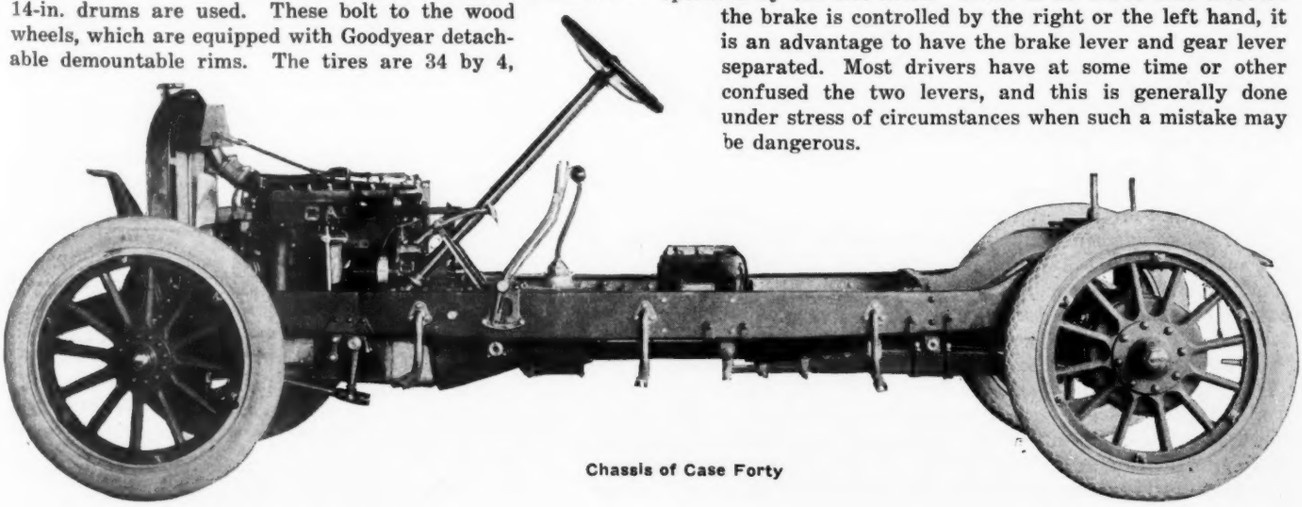
Equipment includes a 6-volt 80 amp. hr. storage battery which is located under the front seat. Thence all the wiring is carried in rust-proof flexible metal conduits. The fuse box is mounted on the back of the combination ignition and lighting switch placed upon the driver's right, being just below the right seat. The headlights are carried on the front fender apron and have a ball and socket attaching device which provides easy adjustment and focus. Double bulb headlights are used with dashlight, inspection lamp and tail light. The dash instruments include ammeter, gasoline gage, and Stewart-Warner speedometer. The windshield is rain-vision, ventilating, tires Goodyear and the top is a one-man design with dust hood and side curtains folding inside. A motor-driven warning signal, a complete set of tools and a tire repair kit are also furnished.

Upholding the Four

The Case Forty is especially interesting, perhaps, because it is one of a now very small class. With the majority of cars at approximately the same price fitted with engines having six or even eight cylinders, the manufacturers of the Case adhere to their belief in the virtues of the four.

To get the best out of the engine no pains have been spared, and it is noteworthy that the design is not laid out so much for cheapness of construction as for efficiency in all ways. An example of this is the use of a cross shaft for driving the magneto. From the viewpoint of accessibility this construction has much to recommend it, but it is unquestionably more expensive than the more usual arrangement. Again, the silent chain for driving the camshaft is not cheap by any means, though it is the accepted practice for all high grade European cars, and for a growing number in America. The body, with its divided front seats is a substantial build with nothing skimped about it either, as to proportions of finish, and the accessory equipment is thoroughly good.

Another point of peculiarity is the mounting of the hand brake lever. In this instance again it would have been cheaper to utilize a central location, but the Case engineers believe that it is an advantage to have the emergency brake operated by the left hand. There is no doubt that whether the brake is controlled by the right or the left hand, it is an advantage to have the brake lever and gear lever separated. Most drivers have at some time or other confused the two levers, and this is generally done under stress of circumstances when such a mistake may be dangerous.



Chassis of Case Forty

Analyzing Engine Cooling

An Accurate Determination of the Factors Affecting Cylinder Cooling and a Quantitative Examination of Air and Water Cooling Comparatively

Results of F. W. Lanchester's Researches Reviewed by A. Ludlow Clayden

ON the question of conductivity it is to be noted that the *pitch of the gills* in terms of the *thickness of the individual gills* at the root, gives the relation of the cross section of metal acting as the conductor in the wall of the cylinder, to the cross section of metal conducting the same heat when the latter has passed into the gill substance, and thus, if the cylinder walls and gills are of the same conductivity, the temperature gradient at the root portion of the gill will be to the temperature gradient within the thickness of the cylinder wall in the same relation as the *pitch of the gills* is to their *root thickness*. Referring to Fig. 5, it will be seen that this is only approximately true, in view of the fact that a small portion of the heat will be disposed of by the outer surface of the cylinder wall itself; however, this is commonly no more than perhaps 10 per cent of the total. If the gill be of uniform thickness from root to tip it is clear that the temperature gradient will be far steeper at the root of the gill than near the tip, because as the tip is approached the quantity of heat to be transmitted becomes less and less, the portion already disposed of at the gill surface being greater. It is evident that a more rational form of gill section will be one tapering off from a maximum thickness at the root where the heat flux is maximum to a knife edge at the periphery where the heat flux falls to zero. In Fig. 6, the heat flow and dispersion is shown diagrammatically.

In connection with the surface disposal of the heat we are not only concerned with the provision of the necessary surface and the maintenance of the necessary air velocity, but it is also obligatory to so design that the quantity of air required to carry away the heat can pass through the jacket air passages; thus if the air passage between any two gills be made of undue length the air will be so greatly heated before it has left the jacket that its temperature difference will be insufficient to make use of the gill surface, although, according to the equation, the latter may be sufficient. The upshot of this is that in the design of the *jacket as a whole*, apart from the design of the *individual gills*, the air channels must be so subdivided and connected in parallel as to pass a quantity of air several times greater than would be theoretically necessary were the air to be raised to the temperature of the gill surface. The factor of importance in calculating the quantity of air necessary is the specific heat of air at constant pressure, which is approximately a quarter that of water, or more accurately 0.24.

The position may be exemplified by the three alternative arrangements of air circulation given in Figs. 7, 8 and 9. In all three arrangements depicted the jacket gills are precisely the same, but in the first arrangement, Fig. 7, it is supposed that the air circulation be taken the complete circumference of the jacket. In the second arrangement, Fig. 8, the air stream is divided, half going one side of the cylinder and half the other, so that for a given velocity over the gilled surface there is twice the total flux. In the third arrangement, Fig. 9, the air stream is divided again, so that now there are four quadrants of the jacket all "in parallel." In this arrangement for a given velocity of air over the gills the flux is four times that in Fig. 7. It will be seen that since the expenditure of energy required to maintain the air blast is due to the skin-frictional resistance of the gills, the arrangements given involve intrinsically the same expenditure power. In other words, it is just as cheap to circulate fresh air over the gilled surface as it is to circulate air which has already been heated, provided the difficulties of design are not insuperable. Where such difficulties exist the "coarseness" of the gills will have to be proportioned to the degree of sub-division found possible, the basis of design being that of the *unit cell*.

The Unit Cell

We have already seen that the heat received by the cylinder walls internally may be approximately expressed, as an average of the whole exposed surface, by a definite number of horsepower per unit area, and that this figure under ordinary conditions may be taken to be 13 hp. per square foot. We have from the equation $\text{hp.} = \frac{\theta V}{15{,}000}$ the means of calculating for any given temperature difference and air velocity the rate of heat loss per square foot from the surface of the gills. Thus we have, for any given quantity of heat passing from the working fluid into the atmosphere, a definite relation established between a unit area of the cylinder wall and the corresponding area of the gill surface by which it is served. This at once gives us the relation between the height of the gill, that is to say its radial dimension corresponding to the direction of flow of heat and the spacing or pitch at which the gills are placed, for, referring to Fig. 5, it is manifest that if h be the height of the gill and s be the pitch or spacing, the relation of external to internal surface is approximately $\frac{2h + s}{s}$

The temperature gradient within the cylinder wall is 23 deg. C. per centimeter thickness. This may be taken as a mean value under conditions of ordinary experience; the temperature gradient at the point of maximum heat flux may be, and probably is, at least twice as great. Since the heat conductivity of copper is eight times that of cast iron, this same temperature gradient can be maintained in the gills with a thickness of copper $s/8$. The copper gills in the author's early models were based roughly on this proportion,

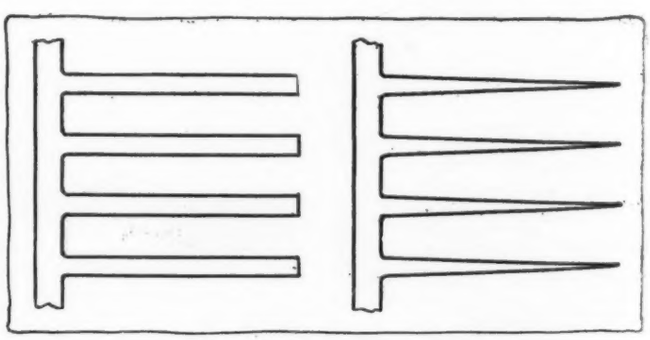


Fig. 5—Types of cooling gill

thus in the gills depicted in Fig. 2 the thickness of copper was 24 s.w.g. or 0.022 in., which is a close approximation to one-eighth of the gill space. In the gills as in Fig. 1 the gill was considerably thicker than here given owing to the difficulty of casting it thin enough; the result being that the thickness as shown is more than appropriate to the conductivity of aluminum. It is by no means necessary, however, that the temperature gradient should be maintained as low as within the cylinder wall; much depends upon the absolute value of h, the radial dimension or height. The thickness of the gill is thus dependent upon the temperature gradient, and upon the conductivity of the metal employed.

Everything points in the future to the adoption of gills of copper or aluminum, as used in the author's early experiments in air cooling. Now the space bounded by two adjacent gills may be regarded as a *unit cell* of the jacket, and the length of this unit cell in the direction of the air flow is determined by the considerations already discussed; if the length is too great the temperature reached by the air before it leaves the jacket becomes too nearly that of the gilled surface, so that the latter will be inefficient. On the other hand, to unduly shorten the unit cell gives no advantage from the point of view of design, and, involves unnecessary weight, or alternatively, too steep a temperature gradient. Making the gills of copper, and designing the cell to give efficient cooling, the height of the gill h should under ordinary conditions be about ten times the pitch, that is $l = 50s$. The unit cell so proportioned is represented to scale in isometric projection in Fig. 10.

Practical considerations have very great weight when we consider how best to arrange an assemblage of unit cells to form the cylinder jacket.

It clearly is desirable to sub-divide the jacket as far as possible, and from this point of view the arrangement given in Fig. 8, is better than Fig. 7, and that in Fig. 9, is better than Fig. 8. However, whereas Fig. 8 lends itself readily to design, the air being admitted to one side of the cylinder jacket and escaping from the other side, the arrangement in Fig. 9 is not one which can usually be entertained. If we depart from the circumferential form of cell or gill assemblage, and arrange the gills longitudinally, it then becomes in most cases impossible to sub-divide it at all; the only practical arrangement is to pass the air in at the one end of the jacket and allow it to escape at the other.

Thus we have two alternative arrangements, which are given diagrammatically in Figs. 6 and 12. In the former the assemblage is circumferential, the basis of circulation being that of Fig. 8 and in the latter the gills are longitudinal; the lower figures representing diagrammatically the arrangement contemplated. In the upper portion of the figures we have a diagrammatical development of the cylinder wall, and thus in Fig. 11 we have two blocks of cells in parallel, the length of the cell being the half-circumference of the jacket; in Fig. 12 we have a single block of cells whose width is the circumference of the jacket, and whose length is that of the jacket in its axial size.

It is a significant fact that in the gasoline engine of ordinary proportions, these two arrangements result in approximately the same length of cell, so that, whatever proportion of cell is appropriate to the one arrangement, the same proportion will, roughly speaking, be appropriate to the other. From this it follows that the cell proportions may rationally be expressed in terms of the cylinder diameter, so expressed we have it that

$$l = 1.6D$$
$$h = 0.32D$$
$$s = 0.03D$$

The thickness of the gill cannot be given in terms of D owing to the fact that it is the temperature difference between the root of the gill and the periphery which is the important factor, and thus the conductivity of the gill must be increased in proportion to its linear height. Since the conductivity of the material used is constant, its effective conductivity must be increased by an increase of thickness. From this it follows that the thickness of the gill will have to be proportioned to D^2.

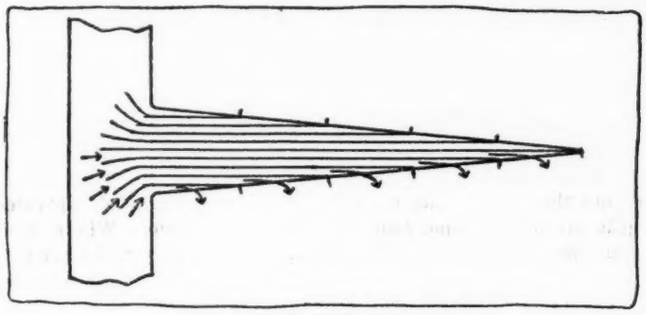


Fig. 6—Flow of heat in gill

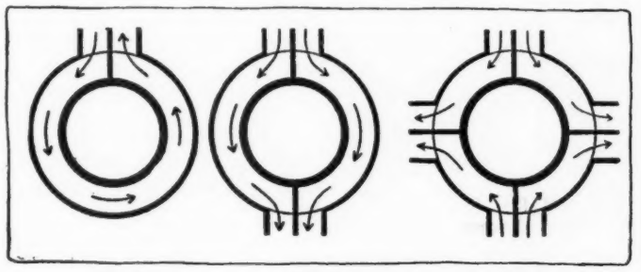


Fig 7 Fig. 8 Fig. 9

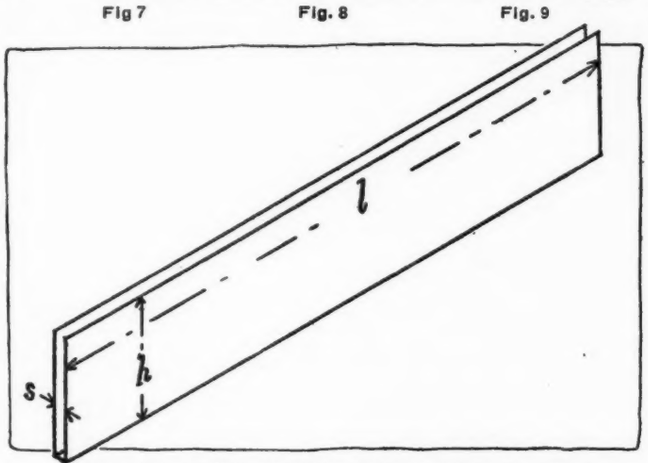


Fig. 10—"Unit cell" conception for calculating air cooling requirements

Means of Supplying Air

In the generation of the air current we are faced with two alternatives; either as in the motor bicycle or the aeroplane the natural draught as due to the velocity of the machine may be relied upon, or when the conditions do not permit of this, a fan of some kind must be employed.

In the author's experimental air-cooled cars centrifugal fans of various kinds were employed.

In the case of the Renault aeronautical air cooled engine, a centrifugal fan, delivering at pressure, is provided for use when it is required to run the engine under stationary conditions, as, for example, when running a bench test, or employing the engine for work other than that for which it was primarily designed.

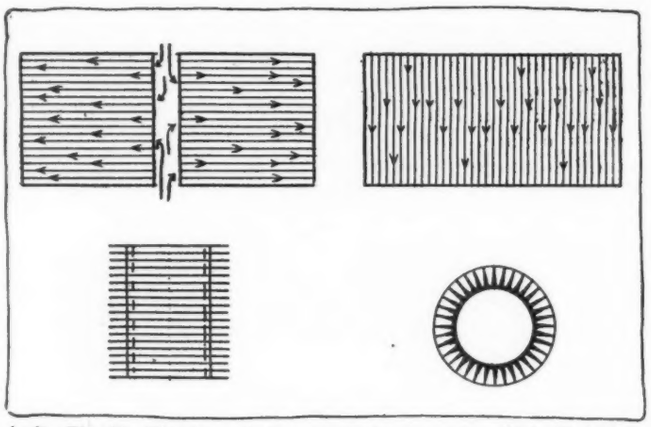
The centrifugal fan is rarely if ever met with in association with water cooling, the arrangement being adopted being almost invariably that of a screw fan placed immediately behind the radiator. In this position it commonly absorbs at speed from one to two and a half horse power, and at that is scarcely to be regarded as an efficient device.

At this point the preliminary considerations of air cooling were concluded, and the author then passes on to consider the problem of water cooling. The next section of the paper deals with the two systems, forced by pump and convection or thermo-syphon cooling. Later on the two systems are considered quantitatively and it is toward the end of the paper that the deductions are made which enable it to be said that air cooling is the lightest system for engines up to a certain size but not beyond that size.

The paper continues:

Circulation of Water

The calculation of the quantity of water to be circulated is a matter of perfect simplicity; we must, however, first settle the *temperature difference* which is permissible between the flow and return temperatures of the water as it enters and leaves the radiator. Now the outside limits of this temperature difference are, on the one hand, the boiling point of water, and, on the other, the temperature for the time being of the atmosphere. It is necessary to considerably narrow these limits, however, for the boiling point must under no circumstances be reached, even by any part or portion of the water; and, as to the lower limit, it is clear that the water cannot be cooled down to the temperature of the surrounding air. Thus for a given velocity the cooling surface has to be proportioned to the temperature difference.



Left—Fig. 11—Diagram of air currents in circumferential gill design
Right—Fig. 12—Similar diagram for radial gills

Now the boiling point of water cannot be taken at the usual 212° F. in view of the fact that cars are required to go over high mountain passes where the boiling point is considerably lowered. If we take the limit of altitude for ordinary purposes of 6,000 feet the boiling point is roughly 200° F. We may therefore take 200° F. as the upper temperature limit.

Now as to the lower limit; if we regard the highest ordinary temperature of the air to be 80° F. we have the total difference of 200—80=120° F. This difference may be regarded as well on the safe side in view of the fact that although a temperature of 80° F. is not uncommon at sea level it is exceedingly uncommon at 6000 ft. altitude; thus the difference stated may be otherwise expressed as equivalent to a permissible air temperature of 92° F. at sea level.

The above is the temperature difference between *air* and *water*. The temperature difference between the flow and return pipes, on which the water flux must be calculated, is far less than this; 20° F. may be taken as a desirable limit, 40° F. or possibly 50 ° F. should in no case be exceeded.

Where convection or "thermo-syphon" circulation is relied upon, the conditions are too indefinite to permit of ready calculation; the proportions are then usually settied by experience, founded on a rough computation. The main difficulty of accurately calculating the convection circulation is due to the fact that the outlet of the cylinder jackets is commonly at a higher level than the lower terminal of the radiator. If the arrangement were a simple one—an engine at the bottom of a circulation system, and a radiator at the top—the necessary calculations would present no difficulty.

There is one point of sufficient importance to be worthy of mention as touching the relative merits of the pump and convection circulating system. It is often found, after a stiff ascent on a car having pump circulation, that if the engine be stopped, the cooling water immediately begins to boil violently; this never happens in an engine in which the convection or thermo-syphon circulation is employed. The reason for this peculiar behavior is that the rate of heat passing through the cylinder walls into the water jacket is, under any given running condition, constant, and on the engine being stopped the rate of transfer of heat from the cylinder walls to the jacket is not immediately affected because of the heat contained in the cylinder wall itself and so, if the circulation is stopped abruptly, when the engine has been working at full load and the water is near the boiling point, there is an instant ebullition of steam within the cylinder jackets, and a quantity of water may be thereby ejected from the overflow. With convection the circulation current does not stop when the engine stops, and so the generation of steam under similar conditions does not take place.

When convection cooling is adopted the author believes that it is preferable to make no attempt to provide each cylinder jacket with separate circulation. The best results are obtained by connecting the jackets one to the other by apertures as large as found possible, so as to virtually convert the whole of the water jackets into a single tank, and by arranging this tank itself to constitute the return pipe.

Type of Radiator

The history of the radiator shows that a great many types and modifications of detail have at one time and another been tried, and in some cases widely developed.

The questions concerned in developing the best type are numerous and varied. Thus at one time flat tubes had a considerable vogue, and many of our leading firms were fitting radiators in which parallel flat vertical tubes were arranged to connect the foot tank to the "header." Now from many points of view these radiators were excellent, but they possessed one serious disadavantage; in the event of steam being raised and pressure generated in the radiator (an event which may accidentally occur from many causes) the flat tubes, bellows-like, immediately expanded, the air space between them became restricted and the steam generation became more pronounced; finally, the walls of the tubes became pressed one against the other until the whole radiator was practically a solid block and the air passages had ceased to exist.

There is a curious difficulty of an entirely different kind which is sometimes experienced with radiators having round tubes. When in such a radiator the pump delivery is brisk the turbulence produced in the header may be so great as to cause numberless eddies and to result in intereference in the flow of water down through the tubes; the eddies give rise (after the manner of the waste pipe of a bath tub) to vortices forming over the tops of the tubes which draw down columns of air. The effect of this is nearly as bad as if the water were to boil, for not only does the air so sucked down displace a quantity of water which is lost through the overflow, but the said air within the cylinder jacket and surrounded by water at near the boiling point is swollen to many times its natural volume by the high temperature and by the water vapor taken up, and when in due course it comes through into the header the result is hardly to be distinguished from actual boiling. It has come to the author's knowledge that such cases have been cured by providing for a *reduction* of the pump discharge.

(*To be continued*)

The Sizes of Motors for Trucks and Outline of British Practice in this Field

By W. D. Williamson

Part 2—Outline of British Truck Motor Design

(*Continued from page* 504, *issue of March* 16)

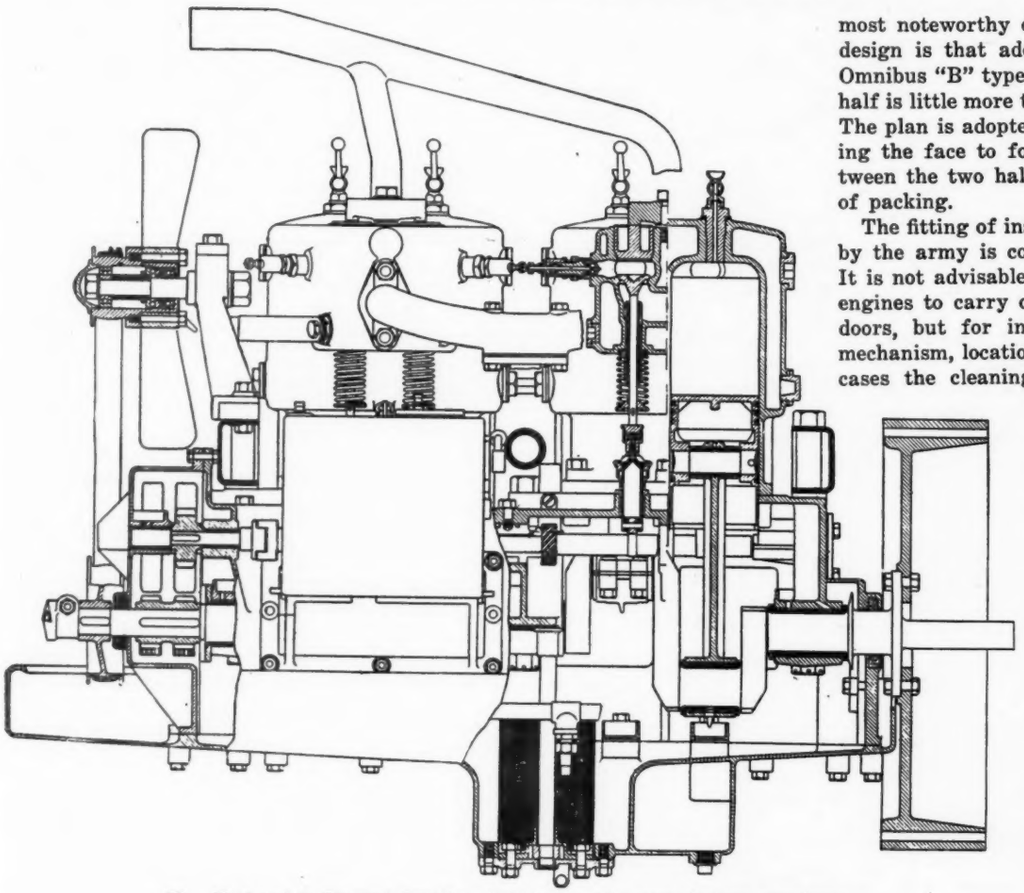


Fig. 13—London General Omnibus "B" type, with very shallow crankcase

CYLINDER DESIGN—Cylinders cast in pairs are the rule.

Austin cylinders are separate castings, however, and the Albion (Fig. 8) is a monoblock.

Ample water jackets with carefully considered arrangement round the valve pockets and stems are found in most modern engines. The plan adopted in the Napier and Pagefield engines of having the cylinders cast with large openings in the jacket at top and sides simplifies molding and insures the jacket cores being thoroughly cleared. With the ordinary small core plugs it is often almost impossible to clear the jackets about the valve pockets.

Crank Cases

Crankcases differ very little in design from those in pleasure cars, although more robust. The usual practice is to split the case horizontally on the center of the crankshaft, carrying the bearings in the upper half, and to use the lower half principally as an oil retainer and dust excluder. External ribs on the lower half, although they may be of distinct advantage for oil cooling, are not general. Perhaps the most noteworthy departure from the usual design is that adopted in London General Omnibus "B" type engines, where the lower half is little more than an oil tray (Fig. 13). The plan is adopted in this engine of scraping the face to form an oil-tight joint between the two halves without the necessity of packing.

The fitting of inspection doors as required by the army is coming into general favor. It is not advisable or even possible in most engines to carry out repairs through these doors, but for inspection of the internal mechanism, location of trouble, and in some cases the cleaning or removal of the oil filter, they are very useful. Any tendency they may have to weaken the case is usually overcome without special provision by the extra metal required for the facing and to carry the studs.

Oil Indicators

There appears to be room for a reliable oil indicator for the dashboard, of somewhat stronger construction than the usual patterns, for use on commercial vehicles.

Engine Suspension

Experiments the author has made show that for any distortion that might occur under normal conditions the ordinary underframe method of construction is quite sound. It appears to be more satisfactory than extending the crankcase arms to the main frame.

In one experiment made with a 4-ton chassis having the engine on a sub-frame, the engine was started and throttled down so that it just continued to run. The near side front wheel was then gradually raised. When the wheel was 12 in. clear of the ground, no difference was discernible in the running of the engine. From 12 in. to 15 in. the twisting of the frame did have an effect, and at the latter height the engine showed signs of stopping. The engine was switched off, and when tested at the starting handle was found to be stiff with the clutch either in or out. The chassis was gradually allowed to fall back again, and at 12 in. the whole of the stiffness had disappeared.

Standing at the back of the chassis, the shape and twist taken by the near side long member of the frame made it appear that three point suspension is more important for the gear box than for the engine. The front of the chassis was

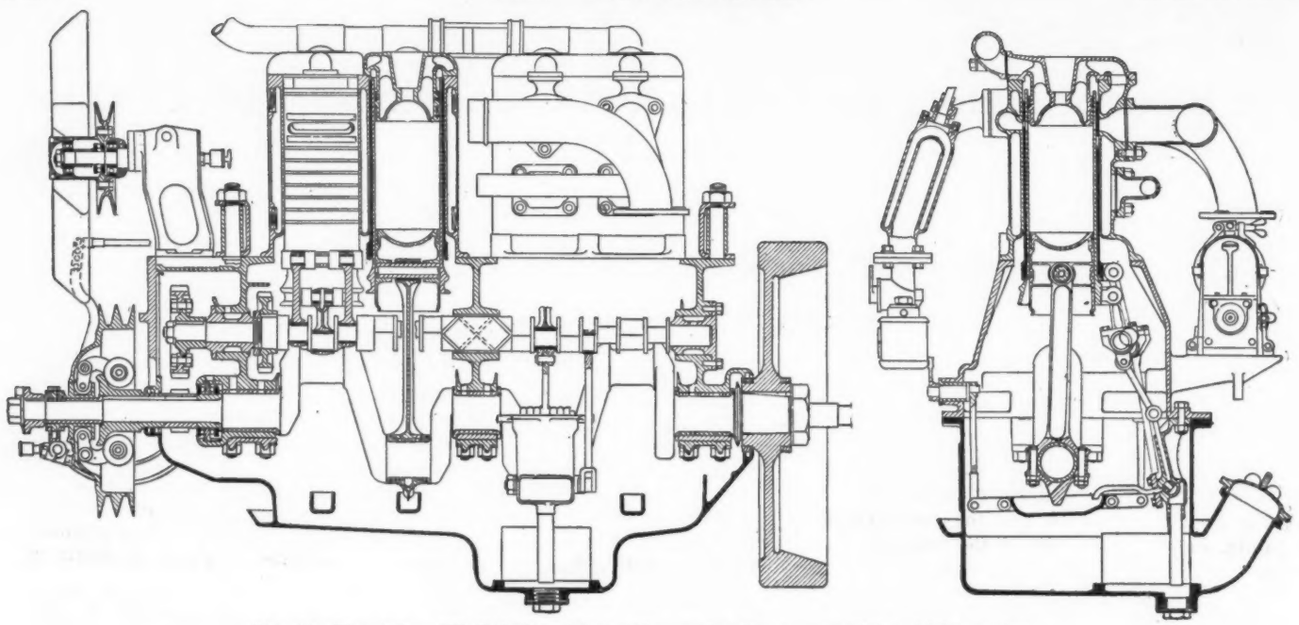


Fig. 14—The 110 x 150 Daimler sleeve-valve motor for commercial vehicle service

tilted on to the off side front wheel, and no doubt helped by the fact that the front spring acted in some measure to restrain the bending of the side member in front, very little distortion was apparent in front of the dashboard. The greatest change of shape was encountered between the dashboard and the front bracket of the rear spring, where the frame was both bent and twisted.

Cooling; Radiator Design

The problem of cooling a commercial vehicle engine, which appeared to present considerable difficulty only a few years ago, has now been satisfactorily solved. Ample water jackets and pipes of larger bore have helped to overcome the original troubles. Lorries now work under the most severe conditions without showing signs of boiling. Practically all cooling systems embody a circulating pump, and this pump is invariably of the centrifugal type. Cooling fans are of robust design, and in most cases mounted on standard type ball bearings. A fan with arms and boss cast in aluminum in one piece, secured to a malleable iron center to serve as the fan pulley, appears to be the most satisfactory type.

The fan driving belts are often much too light for the work they have to perform. They have to transmit quite an appreciable power, and in addition are subject to shocks when the engine speed is altered quickly. The positive drive for the fan in the Hallford is specially worthy of attention.

Turning to the radiator, the type in most general use is the tubular, formed of vertical water tubes soldered to tube plates, and having top and bottom boxes of cast aluminum. Opinion seems to be divided as to whether the tubes should

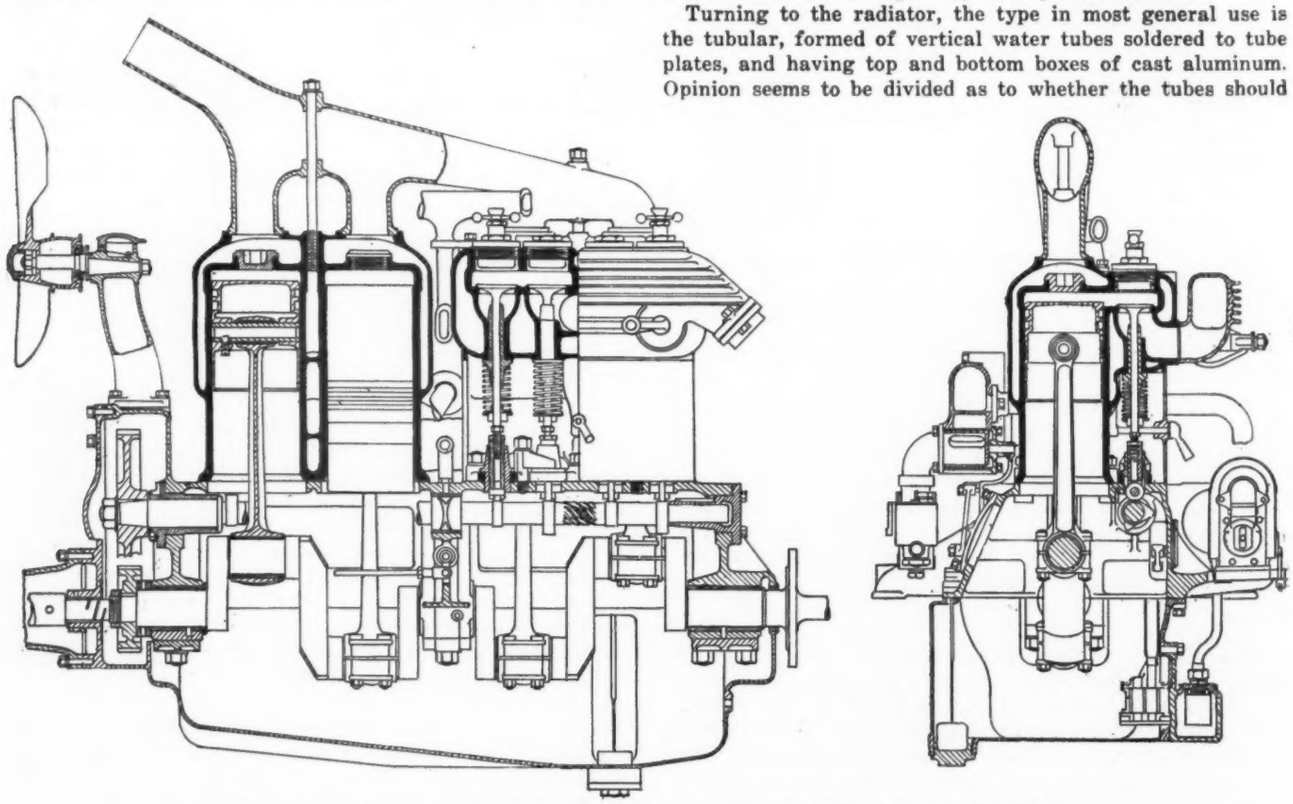


Fig. 18—Sections of Dorman engine, army truck type. Hollow fan bracket used as oil-filler duct

or should not have gills, although the general practice favors gills. The usual tube is of 26 gage brass or copper, 5/16 in. external diameter with gills 15/16 in. diameter or 15/16 in. square, soldered in position at about ⅛ in. pitch. Experiments carried out by a large maker of radiators showed the most useful ratio of gill diameter to tube diameter to be three to one. In these experiments where ½-in. tube was used with 15/16-in. gills for appearance instead of 1½ in., the efficiency fell approximately 10 per cent.

Where plain copper tubes are used they are usually ⅜ in. external diameter by 28 or 30 gage.

Further experiments went to show that the relative efficiency of gilled to plain tubes is about three to one. In other words, three times as many tubes are required in a tube stack having plain tubes as in a stack having gilled tubes. [The many details needed to make the results of these experiments fully convincing—dimensions of air channels, for example, being an important factor—are not given by Mr. Williamson.] Trouble with tubular radiators usually occurs where the tubes join the tube plates, and the reduction of the number of joints, and consequently of the possibility of leaks, is a strong recommendation for the gilled tube type. The gills, in addition, help to stiffen the tubes and afford some measure of protection against damage by impact.

When makers of vehicles commenced to deal with the trouble of insufficient cooling, the tendency at first was to err on the other side. In some cases very large radiators were fitted, having more cooling surface than is now found necessary. Current practice is very well represented by the following formula for a four-cylinder:

Bore in in. × stroke in in. × 8 = feet of 5/16 in. tube with 15/16 in. gills.

This formula does not take into account variations in cylinder design, disposition of valves, and other factors, but it has the advantage that it is easy to handle and gives a result which can be relied upon for satisfactory cooling.

There are engines in commercial vehicles with cooling surface considerably less than that given by the formula. In one case the cooling surface was carefully cut down, starting from bore × stroke × 7, and at bore × stroke × 6.2 the limit appeared to be reached beyond which it was unsafe to go.

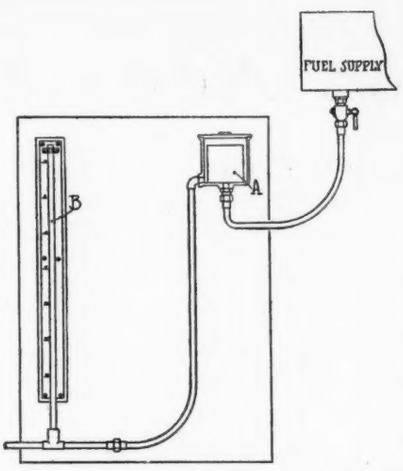


Fig. 17—Dorman Fuel Consumption Gage

A Fuel Gage

The apparatus used in making the consumption tests of Dorman engines while not entirely new is of sufficient interest to merit a description.

The apparatus, Fig. 17, consists of a float chamber "A" arranged so that at rest there is a constant level of gasoline in an open-ended glass tube "B." When gasoline is drawn away to the carbureter, the velocity of the flow past the lower end of the pipe "B" causes the level in this pipe to fall. This fall is constant for any given velocity in the horizontal pipe, but varies with this velocity. Consequently, on a suitably calibrated scale, it is possible to read off the flow of gasoline in any units.

The scale is graduated to show pints per hour, so that the consumption can be obtained instantly.

The advantage of thus being able to ascertain the effect of even the most minute alteration to the carbureter setting will be readily understood.

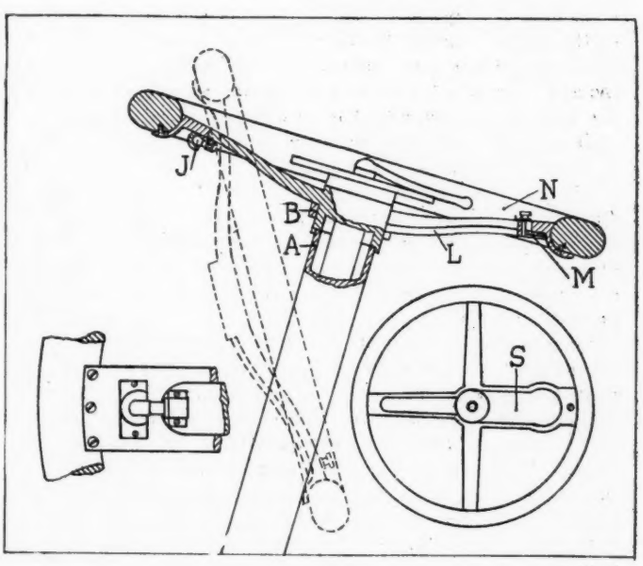
A New Steering Wheel

IN view of the widespread interest in room in the driver's seat an invention recently brought out by a California man, is noteworthy. This is a pivoted steering wheel which has for its object the provision of more room for entrance into the driver's compartment, thus allowing him to use the left door, which on many cars is of little value. Another object of the invention is to provide a steering wheel having a universal joint connection with the steering shaft, whereby the wheel may be turned on the universal pivot and moved out of the way of the driver irrespective of the position of the front wheels of the car. The patent was issued to William A. Fraser of Los Angeles, under date of Feb. 22, 1916. Its serial number is 1,172,696.

Referring to the illustration, a vertical section through the steering wheel is given which clearly illustrates the method of operation. The wheel shown is of conventional design mounted on a hollow shaft through which the throttle and spark adjustments are made. On the top of the steering tube proper *A* there is a collar *B* to which the wheel is attached when it is in the running position. The wheel is provided with a slot *S*, so that when it is swung down about the ball and socket joint *J* the column does not interfere with the movement of the wheel, as it is cleared by means of this slot.

There is a spring member *M*, which is mounted in the recess which holds the wheel in its position when the driver is operating the steering mechanism. The dotted position of the wheel in the drawing shows the space occupied when the driver desires to enter or leave the seat. When it is desired to leave the seat the steering wheel is simply pushed out of the way against the tension of the spring member, thereby operating the latch part *L*.

When it is desired to tilt the wheel laterally, in the event of the front wheels being turned in one direction or the other, the steering wheel may be tilted one-quarter turn.



Timken Adds New Forge Shop

New Building to Contain All Drop Hammers Includes Large Tool Room

THE latest addition to the ever-growing plant of the Timken Detroit Axle Co. is a new forge shop. Profiting by its experience in the forging of weighty pieces on a large quantity basis, the Timken Company laid out its new buildings, which are located across the street from its main works, so as to take advantage of all the light and to bring about utmost efficiency in the making of this highly specialized class of parts. In fact, the new forge differs in many respects from most of the plants of this type.

The feature that is first to attract attention is the unusual height of the hammer room. This is not only with the idea of giving much light and air, but also to make possible the installation of a craneway above the tall hammers. The forge building and the die shop are really one long structure, although the die part is somewhat lower than the forge proper. The buildings have a total length of 650 ft., with the forge part 380 ft. long by 70 ft. wide and the die making room 40 ft. wide. The total interior height of the forge shop is 54 ft., this giving an idea of the room that was provided for the crane.

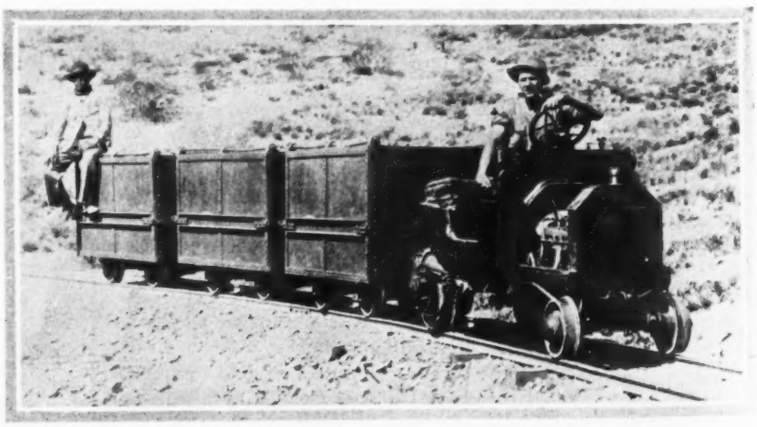
In the forge shop, the hammer equipment consists of thirty-one steam drop hammers of capacities ranging from 1500 lb. to 7000 lb. These are arranged along the outer wall near the windows that extend all the way up and comprise practically the entire wall, and hence the hammer men get a maximum of light and air. Considerable foresight was displayed in the placing of the furnaces for heating the parts to be forged, and in the location of the trimming presses with respect to the hammers. These trimmers have been put at about the positions the furnaces usually are placed, and the latter are arranged at the side of the hammers. When the air blows in from outside, it therefore does not first pass the furnaces before reaching the men, and hence there is no chance for it to become heated. The trimmers do not interfere with the free circulation of cool air. Motion study also had something to do with this placing of the hammer auxiliaries, for it was found that less time was lost in having the men swing around with the heavy forged pieces that had to be trimmed than would be consumed if they had to carry them to one side of the press. Placing the hammers and furnaces in the same line also made it possible to use a monorail satisfactorily in the manipulation of the very heavy pieces that must often be forged. This monorail carries a hoisting apparatus that is worked by hand.

The overhead crane has a capacity of about 40 tons, and it is of immense assistance in the placing of large dies in the hammers and for carrying hammer parts or other heavy machinery as well. When a piston or piston rod must be removed from a hammer, the crane again plays a useful part, for it cannot only pull these out of the hammer cylinder, but can transport them to the point where they are to be repaired. It is surprising that overhead cranes of this kind are not found more frequently in forge shops. Of course, the building must be laid out to accommodate such a device, but the service is of inestimable value.

In the construction of the new plant, ample provision was made for the proper foundations for the immense hammers, and the result is a plant that is strikingly free from jarring and shaking usually attendant upon huge hammers where foundations are none too solid. The concrete foundation running the length of the forge room and under the hammers is 5 ft. thick, while a special setting is given the hammers on 12 by 12 oak timbers that are set endwise and are 5 ft. long. These are bolted together and give a base for the big machines that allows a certain amount of cushioning with utmost rigidity.

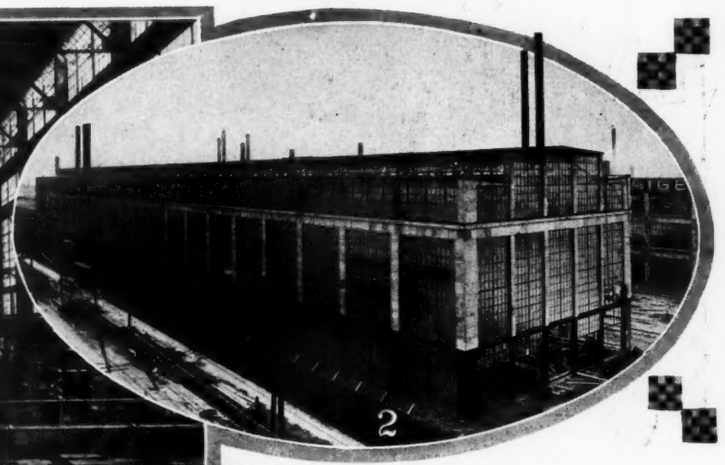
Running the length of the center of the forge shop and in a tunnel measuring 8 ft. deep and 8 ft. wide are all of the pipes carrying the steam to the hammers and the exhaust away from them, the oil supply lines that feed the oil-burning furnaces, and the compressed air that goes to the machines. The hammers are oiled from a central supply tank of 75 gal., it being fed in pipes to each machine under steam pressure. Six 200-hp. Wickes boilers supply the power for the hammers. The coal for these is stored in overhead bins, and is fed to the boilers by an ingenious system of cars that operate on a runway and can be brought into position to send the coal into the hopper of any of the boilers as required.

In the handling of stock that is going to the hammers and in the conveying of the finished forgings to the manufacturing departments, an interesting system is employed. The steel stock yard is located at the side of the plant, and a 5-ton crane brings whatever materials are required to a side entrance to the forge building where it is deposited upon an electric truck that conveys it to the hammers. A powerful shear is also conveniently placed in this stock yard for the cutting of the stock to the right length before it is transported to the hammers within. Finished forgings are placed in steel containers that are kept near the hammers, and when one of these has been filled, the overhead crane picks it up and deposits it on one of the electric storage battery trucks. It is then conveyed down an incline in the front side of the building and through a tunnel under the street that leads to the manufacturing departments opposite. Thus there is little or no delay in handling the forgings.



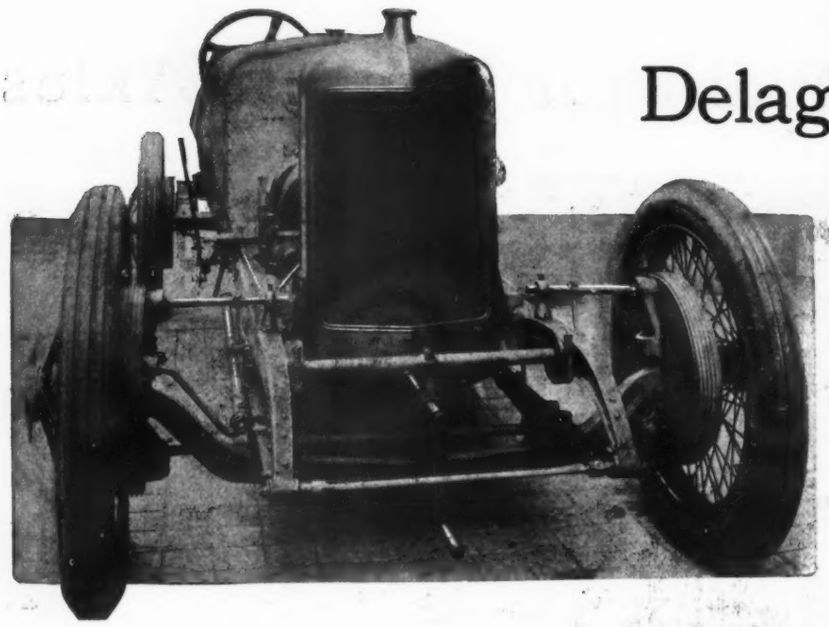
THE Presidio Mining Company has had in successful operation for more than a year a Ford automobile for hauling ore from its silver mine at Shafter, Texas, to the reduction mill. The car is equipped with low, steel flange wheels and runs upon a regular tram track. It is stated by E. M. Gleim, superintendent of the company, that it has proved to be one of the most inexpensive methods of ore transportation that could have been devised. The cost of operating the car, including upkeep, is nominal. It hauls on each out-going trip from the mine three two-ton side-dump cars, or a total load of about 16,500 pounds, without difficulty. The track is of about 3 per cent grade.

Drop Forge Plant for Timken Axles



THE object of drop forging is to eliminate machining on the final products. A front axle, a connecting-rod or a large bevel gear blank would cause much waste of material, time and labor if cut from the solid bar. Thus it is economical to spend lavishly upon the plant for making and using drop forge dies. The first few hundred pieces struck by the die pay for the apparently high initial cost. The Timken Co. have one of the finest forge equipments and a large proportion of their front and rear axle parts come from the hammers almost in their finished state.

1. *Interior View of drop forge.* 2. *Exterior view of drop forge plant looking from roof of main Timken Detroit plant on Clark Street.* 3. *Interior of die shop.* 4. *Another view of die shop showing battery of planers.*



Delage Cars Make Strong Team

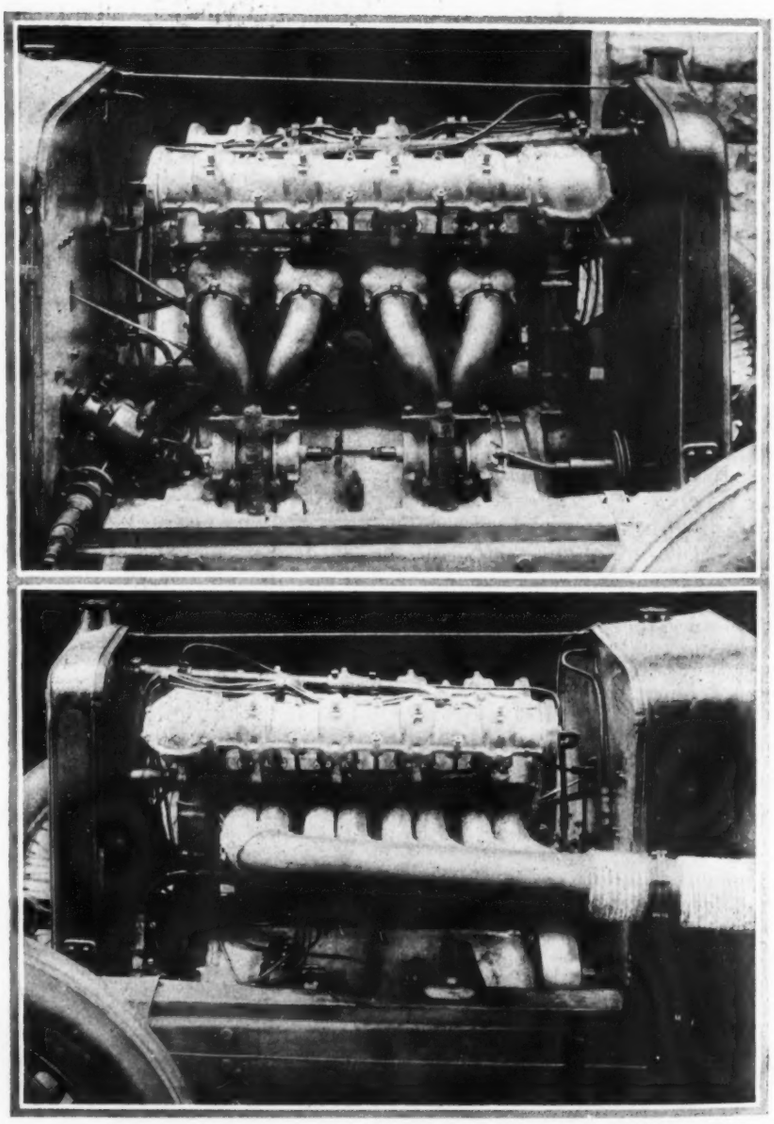
Harry Harkness Has Newest European Racing Cars — Have Run Only One Race—Should Be in Perfect Condition For the Speedways

AS announced in THE AUTOMOBILE last week, the three Delage cars which took part in the last French grand prix are now in New York, and will make their appearance on the speedways very shortly. These cars have been imported by Harry Harkness, and will be managed by Carl Limberg, who will drive one of them. Drivers for the other two are not yet picked.

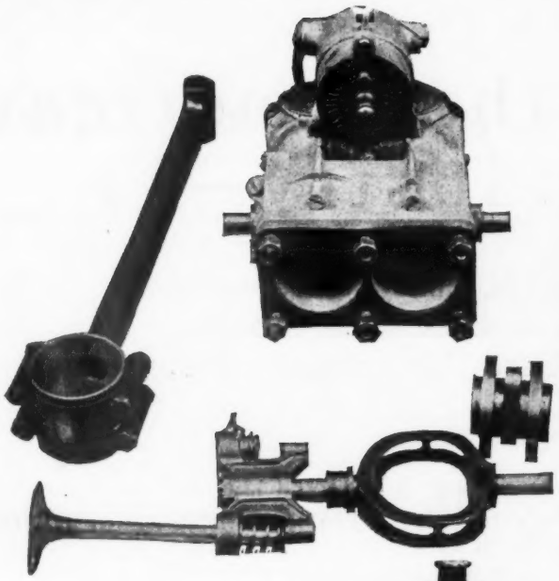
At the time of their first appearance, these cars were wrapped in much mystery, their details being kept very secret. Gradually it leaked out that their especial novelty was a set of sixteen poppet valves, each of which was both shut as well as opened by a cam, the spring forming only a cushion. Exactly how this was done has never been allowed to escape, though some diagrams were obtained showing the principle. One of these was published by THE AUTOMOBILE on July 9, 1914, and the photograph of the actual parts on the page opposite shows that the actual pieces are very much like the diagram. There are three cams to each pair of valves, the midmost lifts the valve by pushing down a stirrup that surrounds the cam, and the two outside cams bear upon the side pieces of the stirrup and pull the valves shut, acting through two springs.

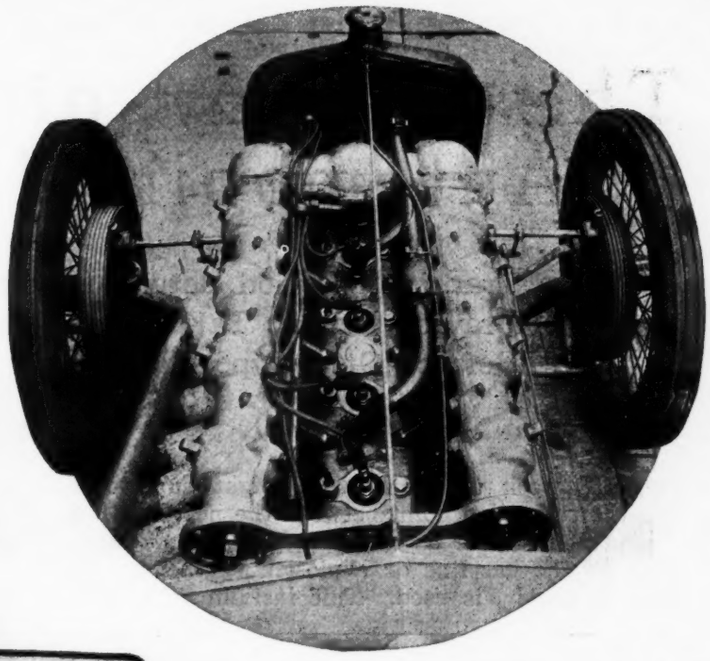
In the practice spins before the race Bablot, who had one of the trio, astonished the fans by making a lap in minutes less than most of the others, and from that time onward the Delage team was reckoned to be about the fastest in the field. On the race day, however, some petty maladjustment of the carbureters made at the last moment upset all calculations, and the Delages did little to justify the high hopes of their backers.

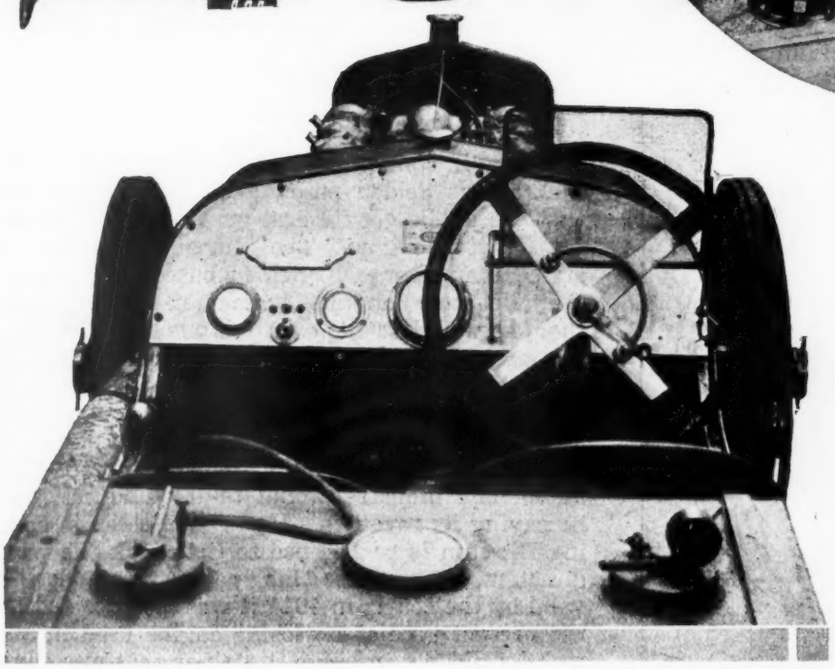
Still everyone recognized that it was an accident, and that it was no fundamental fault that had caused the trouble. Since July 4, 1914, the speed machines have been resting under a coat of oil. They are essenially as good as the day they left the factory; they are more nearly new than any European car in America to-day.



Alternate sides of the Delage engine giving a good idea of the valve mechanism







Above—Details of the valve gear, the cylinders and the hollow connecting rod. Below—The driver's view of the car. The long plate above the gages on the left is a lap recorder to be worked by the mechanic

Thus it is reasonable to expect great things of the team.

The photographs herewith show more detail of the cars than has so far been published. It will be seen that the two camshafts are driven by a single vertical shaft with a nest of bevel gears at the upper end, the spark plugs being in the center of the cylinder heads. A small peculiarity is that the cylinders are bolted on from beneath the studs fitting in the cast iron foot with the nuts inside the aluminum crankcase. The valve mechanism shown just beneath the cylinder has the stirrup turned at right angles to its proper position so as to show the whole part in one photograph. There are two Claudel carbureters on each engine, operating simultaneously with throttles interconnected.

Because of the very hilly nature of the last grand prix circuit in France five speeds are provided with direct on third, and the nature of the road also dictated the use of the large front wheel brakes. In addition to these there are a pair of brakes on the rear wheels and a transmission brake as well.

The engines are well within the 300 cu. in. limitation being 94 by 160 mm. or 3.7 by 6.3 in. This gives a piston displacement of almost exactly 270 cu. in. The wheelbase is 106 in., and the tires 34 in diameter on Rudge Whitworth wheels.

At present the bodies are little more than seats, as the many curves of the French course made the value of streamline tails quite doubtful. Just back of the seats there is an immense tank for gasoline and oil, the latter being fed by hand pump when desired, and circulated in the engine by a centrifugal system. It is planned to inclose this tank, and to provide each car with a body more suited for speedway racing.

Being more nearly new, the Delage team ought to prove much more formidable than did the Peugeot team last year, as in the latter the only really new car was Resta's, the others being already well worn. It is unquestionable that the presence of this new trio will make a substantial difference to the keenness of competition on the speedways this coming racing season on the speedways.

From an engineering viewpoint it will be very interesting to see how the latest Delage engines stand up to the strenuous requirements of speedway competition. Originally these cars were designed for road racing on a course where gears were shifted almost every quarter of a mile for a third of the circuit, but there was one very long straight, over eight miles, where speeds of 110 miles and over could be attained. There was a long hill, where the engines could revolve at their maximum speed on the lower gears, but there was a descent giving quite a respectable rest to the motors at the end of the long straight.

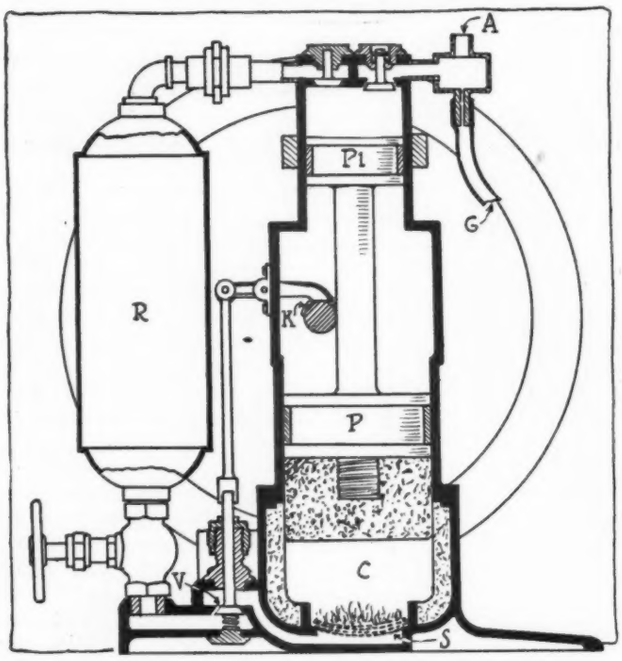
On the speedway where there is no rest period the conditions are more difficult for engine durability, but since the Peugeot engines proved equal to the stress, there is every reason to expect a corresponding performance from the Delage cars, and these machines were undoubtedly faster than the 1914 Peugeots when opened out to the full. They are almost sure to win something.

The History of the American Automobile Industry—22

Transition Period Between Old and Modern Development—Brayton Engine Taken by Selden as Basic Was Last Stage Before Otto Type Which is Used Universally Today

By David Beecroft

THIS week we reach what might be termed the transition point between the past and the present so far as the history of the development of the gasoline or explosion engine, as we know it to-day, is used. This installment brings us to the engine patented and built by George B. Brayton of Boston, Mass. The patent was taken out April 2, 1872, and the engine known as the Brayton was the popular and accepted type from that date until 1880 or later. Brayton had been working on his engine for over 20 years; in fact, from a few years after Stuart Perry issued his patents.



BRAYTON'S TWO-CYCLE ENGINE 1872

This engine with a single vertical cylinder used a compound piston, the lower portion P known as the working piston, and corresponding with the piston in a gasoline engine to-day and the upper portion Pl serving as an air pump to pump a mixture of air and an explosive gas into the larger reservoir R where it was stored under 60 pounds pressure. The reservoir was of approximately double the capacity of the cylinder. From this reservoir gas was admitted into the combustion chamber C through a poppet valve V. This valve was opened by the cam K through the medium of a rocker arm and vertical tappet. In the bottom of the combustion chamber C was a series of five or six thicknesses of wire mesh covering the large opening in the cylinder base. The mixture of air and gas entering the cylinder under pressure had to rise through these meshes. Above the meshes was kept burning a constant flame and which ignited all of the incoming gas. The piston P was driven upwards by the expansion due to the heat from the burning of the gas rather than from any explosion. The air pump piston Pl drew a mixture of air in through the opening A and the mixture of illuminating gas or some hydrocarbon vapor through the opening G. These were drawn in at the ratio of 12 volumes of air to 1 volume of explosive gas. In the top of the cylinder were the usual valves for regulating the openings between these pipes A and G and the reservoir R. Owing to the constant fire in the bottom of the cylinder it was necessary to carry on the bottom of the piston a substance such as soap stone capable of sustaining a high degree of heat without injury. The combustion chamber was also lined with a similar material. The illustration does not show the engine as being water-jacketed but in actual use it was water-jacketed.

It was in connection with the final settlement of the famous Selden patent suit in January, 1911, that the public got its first general introduction to the Brayton engine. The judges in that decision stated that George B. Selden based his patent on the Brayton engine which naturally Selden thought would be the eventual one for all automobile uses. Later events proved otherwise, and that the Otto design, which will be described later, was the real pioneer of the present explosion engine as we know it to-day. Had Selden selected the Otto design instead of the Brayton the American automobile industry would to-day unquestionably be paying its royalties. However, Selden in selecting Brayton in preference to Otto took the wrong direction, and while his patent was declared valid by the courts in 1911 it was also decided that the present type of explosion engine used in automobiles did not infringe it, rather that our engine to-day sprang from the Otto type.

Before describing Brayton's engine we should first realize that it was not an explosion engine as we understand it to-day. It is true Brayton ignited a mixture of air and a combustible gas, the mixture being a 12-to-1 ratio, but Brayton in his patent makes it particularly plain that the expansion in his cylinder was not an explosive force on the piston, but "a true pressure due to expansion on account of the fact that the piston is at the very commencement of its stroke when the expanding gases begin to act upon it." Brayton had the idea that the pressure as obtained in steam engines was the one for explosive engines.

Further: Brayton did not employ a carbureter device such as we understand it, but rather used a storage tank in which he mixed the air and gaseous vapor. He pumped them into this storage tank and kept them under pressure. He then let this explosive mixture flow into the working cylinder under its own pressure. As soon as the mix-

ture entered the bottom of the cylinder it was ignited by a flame which kept burning all of the time. He did not have ignition as we understand it, but simply a constant-burning flame. Brayton had a regulated intake valve much as we understand it which controlled the entrance of the explosive mixture into the cylinder. This valve was opened and closed by a combination of cam, tappet, and springs, quite similar to systems employed to-day.

Brayton had to have with his engine an air pump which kept the reservoir filled with a mixture of air and explosive vapor under a uniform pressure. This air pump was really a part of his motor so that the piston of the air pump was really a continuation and integral portion of the piston in the working cylinder.

Not Strict Explosion Engine

It will thus be seen that although Brayton's engine proved a popular one in the 70's and gave every indication in those days that it might develop into the possible engine to be used on automobiles, still it was not a strictly explosion engine, but bore a striking resemblance to steam in that the charge of air and gas was carried in a separate reservoir to be drawn upon as necessary, just the same as steam is carried under pressure in a boiler and drawn upon as needed. Brayton did, however, get away from one feature of steam, namely, he used a single-acting piston; that is, the explosive mixture was admitted at one end of the piston only as is done to-day. Steam engines are double acting; that is, the steam enters at each end of the piston, and up to Brayton's time all inventors of explosion or gas engines used the double-acting system. Brayton thus marks the first radical step in departure from the double-acting engine to the single-acting engine of this date.

Brayton's engine was constructed in a thoroughly mechanical manner, and was unquestionably the best explosion engine yet produced. It, therefore, began to win approval wherever shown and one was exhibited at the Centennial Exposition in Philadelphia in 1876, where it was utilized to pump air for the Aquarium.

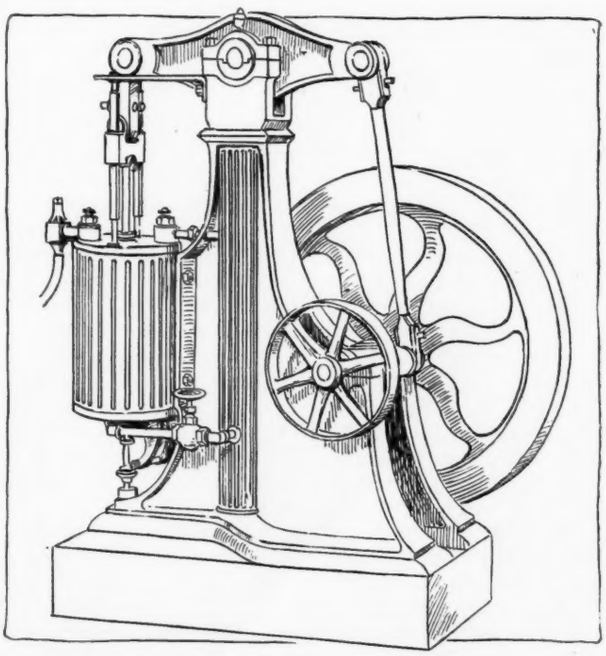
A section of the Brayton engine illustrated herewith shows its general scheme of operation, with its compound piston, the lower portion *P* forming a working piston and the upper portion *P I* being an air pump to store the mixture of air and explosive gas in the reservoir *R* under a pressure of 60 lb. The crankshaft does not appear, but how the engine was worked out can be judged from an external view of it, also shown. A very large-diameter flywheel was used. The mechanically operated intake valve *V* opened by the cam *K* through a rocker arm and tappet appears. The spring to close the valve is also shown. When this valve was opened the mixture from the reservoir *R* immediately rushed in to fill the space *C* below the piston, but on entering the piston through the large opening at the base it had to pass through five or six fine mesh screens. Above these screens was a constant ignition flame, also supplied with gas from the reservoir *R*. Thus the gas rising through the screens or mesh started burning and it was this burning coupled with the pressure of the gas that raised the piston. There was not any sudden explosion as we know to-day, but rather Brayton relied on the expansion due to the heat from combustion.

When starting the engine it was first necessary to open the throttle wheel shown below the reservoir *R*. The constant flame for ignition was next ignited. This done, the large flywheel was turned over by hand until the valve *V* opened. The inrushing gases then began burning and the pressure lifted the piston. The momentum of the flywheel was then sufficient to carry the piston down until the valve *V* was again opened. Thus the cycle of operation was continued. There was no cycle of operation, as we know it to-day, that is, induction, compression, explosion and exhaust. There were but two cycles, combustion and exhaust. When the engine had to be stopped the hand throttle wheel was turned, shutting off the supply of mixture from the reservoir *R*. The heat expanded the air to a much larger volume so that although working at a pressure no higher than the air pump pressure it, because of the larger piston area and larger volume, would not only drive the air pump piston but yield considerable power available for work besides.

Used Accurate Oil Pump

Brayton developed an oil pump that, although not of delicate construction, permitted accurate adjustment of the oil supply and to a large extent governed the engine by varying the amount of oil admitted. His great problem, of course, was to get a proper mixture and to continue the combustion from one admission of air to the next. His

(*Continued on page* 560)



External view of Brayton engine

The FORVM

ANALYZING FRONT END OF CHASSIS—SPRING ACTION AFFECTS STEERING—FUNDAMENTAL FAULTS IN CONVENTIONAL DESIGN

Faults in Front Spring Suspension

By H. H. Dyke

THE forward spring suspension of an automobile, to be mechanically correct, must serve three purposes: First, to act as a cushioning buffer between the front axle and the frame; second, to prevent side sway or lateral movement of the front axle and wheels relative to the frame and body; and third, to permit the spring or cushioning movement bebetween front axle and frame to take place without interfering with the proper action of the steering connection. A front spring suspension that does not do these things, and all of them, is mechanically defective.

The front axle suspension in substantially universal use to-day is illustrated in connection with the usual fore and aft steering link in Fig. 1. This arrangement prevails in 95 per cent or more of the maker's designs. There are several other types in use, to be sure, but this is practically standard construction.

This standard type fulfils the first and second conditions referred to above admirably, though even as to this a substantial improvement could be made at little or no additional expense. This improvement could be secured by the substitution of a pull shackle for a push shackle at the rearward end of the spring, as is already done in some makes of trucks and has been adopted just recently in at least one make of passenger car and as sketched in Fig. 2. A pull shackle naturally takes the right position, but a push shackle is always canted as far as it will go to one side or the other, and wear, once started, progresses with great rapidity. Any worn front spring bolt which has been in use with the type of suspension illustrated in Fig. 1 will be found to be worn as in Fig. 3. Such wear is due to this canting action of the push shackle.

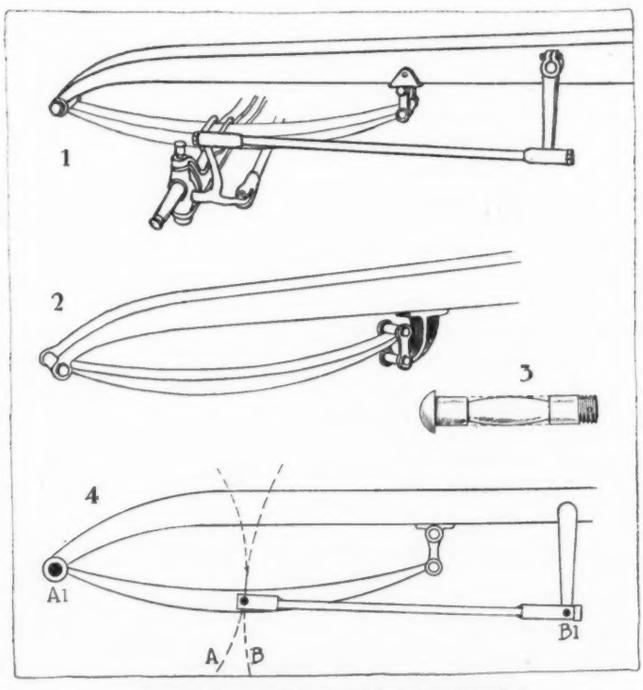
The Cause of Wobble

But where the type of either Fig. 1 or Fig. 2 fails, is in the third of the enumerated essentials for a front spring construction. Proper steering action is very seriously interfered with. With such arrangement the front wheels wobble from side to side every time they move up and down.

The steering connections enter into this matter along with the front springs and axle. The standard arrangement of steering connection from frame to axle, in all fairly good sized cars, at least, is to place the steering gear well back in the frame, with the steering link at its rear end pivoting on the steering gear arm and running forward from the steering gear arm to the steering knuckle arm on the front axle, and it may readily be assumed that this construction will remain standard, for with any alternative construction, the steering link must run crosswise or partly crosswise of the car, which is obviously undesirable.

The cause of the wobbling action of the front wheels is shown graphically in Fig. 4. It is due to pivoting the front axle by the forward ends of the springs to the extremities of the horns projecting forwardly from the frame about 18 in. *in front* of the axle and placing the steering gear on which the steering link pivots about 2½ ft. *back* of the axle, thus bringing these two pivotal centers nearly or quite 4 ft. apart. When there is any up and down spring action the front axle moves in the circle A because the spring has a fixed pivot at its front end at A′, the center of A, and the knuckle steering arm carried on the axle should naturally move in the same path A. The forward end of the steering link which is pivoted to the steering gear arm at its *rear* end would naturally move in the circle B which has B′ for a center, but the knuckle steering arm on the axle and the steering link are fastened together and must move together notwithstanding the upward and downward divergence of their separate natural paths.

How is this accomplished? The answer is rather complicated, for it is divided into a number of parts, but take the worst situation first. If we have a snug fitting, irreversible steering gear and a steering link without the customary flexible connections at its ends, the point or center B′ is fixed, and the forward end of the steering link and the end of the knuckle steering arm attached thereto must move on the curved line B notwithstanding the axle to which the latter is secured by the king bolt moves on the curved line A. Thus for any up and downward spring movement of the front wheels and axle there is also a wobbling or turning move-



Figs. 1 to 4—Analysis of front suspension

ment of these wheels from side to side, just such a movement as you would get by grasping a front tire and turning the wheel back and forth pivotally on the garage floor, the car standing still meanwhile. This pivotal movement is responsible for much of the wear on the front tires. The best way to see clearly what this means is to examine the track of a car which has passed over a soft spot in the road where there is a deep hole causing excessive spring action. The front wheels make drunken tracks, which are covered only partially by the straight tracks of the rear wheels and show alternately on each side, this drunken wake gradually fading out and disappearing as the spring action decreases.

In ordinary practice, in addition to this castor or pivotal or wobbling movement of the front wheels the conflict of the circular paths A and B is distributed in several other places. The flexible socket joints in the two ends of the steering link take up some of it. The point B′ is never absolutely fixed in practice, but there is play in the worm and worm wheel of the steering gear, and this accounts for some of the movement, and, incidentally, is a prominent factor in steering gear wear; and finally, the steering wheel itself, particularly where the gear is not irreversible, turns every time there is any spring action between the front axle and the frame or body. Watch the steering wheel of any car with a bevel steering gear and you will see how the steering wheel turns every time you hit a bump with the front wheels. This has much to do with the popularity of the irreversible type of steering gear.

The present standard construction has, of course, certain advantages or it never would have attained its present almost universal use. It is simple and strong. The front axle is pulled by the spring and not pushed by it. It is generally considered to be of good appearance. At least the car-wise public has gotten used to its appearance and is satisfied on this score. The public acquiescing, car manufacturers have come to regard it as "good enough," and undoubtedly its substantially universal use is dependent on the fact that car makers are averse to trying to force something on the public which it does not want. Once the public comes to know the various evils that are inherent in this mechanically incorrect type of front spring construction, however, the wobbling of the front wheels, the extra wear on the front tires, the extra wear on the steering gear, and particularly the movement of the steering wheel itself making driving harder and more tiresome than it should be, we may begin to look for a different attitude and a demand for a construction which will do all that that now in use will do, but which will not have its many disadvantageous and unmechanical features.

Suggests Elimination of Left Door

By K. F.

J. E. SCHIPPER'S article has opened a very old subject for discussion from which we can all learn something by airing our opinions. Several comments are that the designers are overlooking the comfort of the drivers. This may be in a few cases, but I am sure if there is not some comfort in the cars the designers would have heard from the sales-manager a long time ago. Even if they have picked out a good average condition they will have had an adverse comment from some of their sales branches.

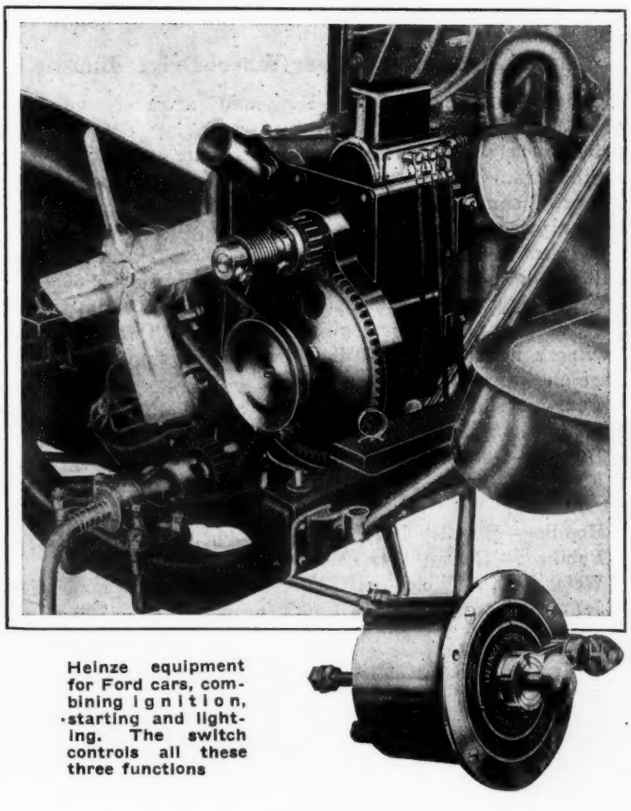
Room under the steering wheel, graduation of the cushion, hardness or softness of the trimming will be discussed as long as we turn out cars, and there will be a difference in opinion somewhere. Some cars permit of giving their customers a better range than others; some permit of adjusting these elements, but where the greatest rub comes, is in the highly developed cars that sell for a very low price and are made in large quantities. These are designed with every piece and fraction of an inch of material considered, as the hundreds of parts that go to make a car, with an excess of even a small amount on them multiplied by the thousands that are to be made of them comes to a very formidable figure. The wonders that are being accomplished with tin, imitation hair, and leather are seen everywhere in happy parties on all roads. They are testimony to the highest skill in industry.

In the modern cars the steering wheels are larger and the sides higher. The size of the wheel and seats being fixed, then unless the doors are made to open up the entire side of the seat or nearly so, we have the condition of a squeeze through for the driver if he wants to get in from the left side. On the cheap cars who not eliminate the left front door.

Heinze Installation for Fords

A TWO-UNIT electric lighting and starting system for Ford cars incorporating the Bendix automatic drive has been put on the market by the John O. Heinze Co. of Springfield, Ohio. The starting motor is a simple series-wound machine of the four-pole type designed to be compact and light. It is operated by a starting button dash switch, which completes the circuit and causes the automatic Bendix drive to mesh with the intermediate gear mounted on the generator shaft. This is connected to the crankshaft by silent chain through which the cranking drive is transmitted.

The Heinze-Springfield generator is driven by the chain through which the final starting drive is obtained. The generator is also a four-pole instrument, shunt wound and designed to deliver 6 volts. The cut-in speed is quite low, the maximum charging rate being attained at 10 m.p.h. The regulator is mounted separately in a small box on top of the starting motor. The installation is clearly illustrated on this page. A feature of interest is the dash switch which controls lighting, and ignition as well as starting.



Heinze equipment for Ford cars, combining ignition, starting and lighting. The switch controls all these three functions

The Rostrum

Timing of Sheepshead Bay Packard

Editor THE AUTOMOBILE:—How were the valves timed in the 102 m.p.h Packard used by Mr. Vincent at Sheepshead Bay?

2—What compression was used? What is formula for figuring same?

3—What is the valve timing of the special Stutz and Duesenberg motors?

4—Why do some motor manufacturers open intake valve before closing of exhaust?

New York City. J. B. W.

—The Packard used at Sheepshead Bay had its exhaust valve open 60 deg. instead of 45. The latter figure is standard on the Packard Twin Sixes. The inlet valves remained open 50 deg. late instead of 35 deg. The exhaust valve closed 40 deg. late and the inlets opened 9 deg. late, the same as standard. The valve lift was 7/16 in. instead of 5/16 and the pistons were crowned to give 90 lb. gage compression at 120 r.p.m. The standard motors carry 75 lb. compression.

2—This is answered under question 1 partly. Compression pressures are not figured by formula as a rule but tested by gage, as the theoretical compression is never equal to the true compression because the gas in the cylinder is not compressed either isothermally or adiabatically, but somewhere between the two.

3—The timing of the Stutz and Duesenberg motors was published in THE AUTOMOBILE for Feb. 3 on page 234.

4—So that the valve shall be fully open during the effective part of the suction stroke.

Manufacturers of Four-Wheel-Drive Busses

Editor THE AUTOMOBILE:—How many are there and what are the addresses of manufacturers making a four-wheel-drive truck, something large enough to put a hotel bus body on that would carry about fifteen passengers? What are the prices of same?

Plentywood, Mont. J. A. K.

Fifteen passengers, at 150 lb. each, close to the average, will weigh about 2250 lb. A bus body will weigh about 1200 lb. The total load will be 3450 lb. This load is not net, however, as you must subtract at least 500 lb. body allowance, leaving a net load of 2950 lb. This will leave a liberal baggage allowance on a 1½-ton chassis.

Four-wheel-driven trucks of 1½ and 2-ton capacity are made by the following, for the prices per chassis given:

Duplex—Duplex Power Car Co., Charlotte, Mich., $2,800.

F. W. D.—Four Wheel Drive Auto. Co., Clintonville, Wis., $3,600.

Hoadley—Hoadley Bros., Gosport, Ind., $3,000.

Robinson—Golden West Motors Co., Sacramento, Cal.

Weier-Smith—Weier-Smith Truck Co., Birmingham, Mich.

Jeffery—Thos. B. Jeffery Co., Kenosha, Wis., $2,750.

Kink for Putting Tires on Rims

Editor THE AUTOMOBILE:—After an unsuccessful attempt to put on a quick-detachable tire which would not allow the two q.d. rings to be put into place, I tied the shoe together in five or six different places, using strong brown cord for the purpose. This brought the two beads of the shoe close together and when I put the tire on the rim, the two q.d. rings were easily slipped into place without the use of a hammer. The pieces of cord were then cut and pulled out and the tire inflated. This scheme is particularly valuable when reliners are used. I make my own reliners out of the fabric of my discarded shoes, allowing a small strip of the tread rubber to remain on the finished reliners and I get over 10,000 miles of service out of my tires and no punctures or blowouts. Such reliners must, however, be carefully made and must have all edges well fastened down and new inner tubes must be used.

If strips of rubber from a discarded inner tube are placed between the leaves of springs, it will stop squeaks and will add wonderfully to the riding qualities of the car.

A very annoying rattle difficult to detect on a Ford car and which sounds like a mudguard rattle. is really caused by the brake rod striking against the rear support of the running board. This noise can be stopped by securely fastening a piece of rubber or fabric around the brake rod at the point where these two parts come together.

Brooklyn, N. Y. E. H.

Timing 1907 Fiat for Road Racing

Editor THE AUTOMOBILE:—I have a 1907 four-cylinder Fiat which I want to use for road racing. Bore is about 5⅛, stroke about 6¼. It has 36-in. wheels and is geared 2¼ to 1 on fourth gear.

1—What size and how far apart should I have holes in skirts of pistons?

2—Would it be worth while to bore holes in connecting rods? Would they stand it?

3—I can enlarge intake and exhaust valves ⅜ in. Is it worth while enlarging intakes?

4—Will you show drawing with dimensions of best cam action possible for my motor?

5—Can I enlarge intake and exhaust ports of my cylinders?

6—Are the Su-Dig spark plugs for obtaining two simultaneous sparks from a single point magneto successful?

7—Can I increase the stroke of this motor? If so, where can I get a suitable crankshaft?

8—Would it be advisable to set plates in cylinder heads to increase compression?

9—Is there any way of obtaining a vacuum in the exhaust pipe? I understand that some Mercedes racing machines had a sort of inverted megaphone attachment on the exhaust pipe that caused a suction at higher speeds.

Will you kindly offer any suggestions that may occur to you so that I may obtain a speed of 100 m.p.h. or better?

Great Neck, L. I. J. A. R.

1—Use ½-in. holes at least 1 in. apart.

2—This has been done with the result of lightening the rod ¼ lb.

3—Yes, this would help if it could be done.

4—This is a matter for experiment and one which THE AUTOMOBILE cannot handle without opportunity for making tests.

5—This is inadvisable.

6—Yes. It would probably be advisable to use a double magneto for high speed work.

7—It can be done but it is almost certainly inadvisable.

8—It is not necessary to increase the compression on this motor.

9—By arranging the exhaust to secure an injector action an injector effect can be created. The actual value of it is debatable.

There are two principal things which will help you in addition to obtaining more power. First, cut the weight wherever possible, and secondly, examine and adjust every bearing throughout the transmission and wheels so that the car rolls as lightly as possible. A good racing car can be moved with one finger on a smooth road.

Information on Stewart Vacuum Feed

Editor THE AUTOMOBILE:—Kindly give me the following information about the Stewart vacuum gasoline system.

1—Why is it that the vacuum tanks vary in size? I have seen some that looked about twice the size of others. As the tank is being filled as fast as the motor needs gasoline, I should think that the small size would work equally well, and have the advantage of light weight and compactness.

2—One of the advantages claimed for the Stewart system is the positive flow of gasoline on steep grades. But as the vacuum tank is placed on the inside of the dash in many cars, this being quite a distance from the carbureter, what advantage has this as regards the flow of gasoline over having the main tank in the dash?

3—Does every car have the vacuum tank so placed that it will work perfectly on the steepest grade a car can encounter?

4—What is the percentage of commercial vehicles having the Stewart system? R. B. W.

East Orange, N. J.

—Vacuum tanks vary in size because certain motors require larger capacity in the lower chamber of the vacuum tank than others do.

2—Gasoline flows from the reservoir chamber of the vacuum tank into the carbureter by gravity just as it flows from the cowl tank into the carbureter. However, it is usually possible to locate the bottom of the vacuum system higher above the carbureter than the bottom of a cowl tank. The vacuum system is particularly advantageous in that it allows the gasoline tank to be at the rear of the car.

3—As far as we have any record, no case has yet been reported of a car so equipped encountering too steep a grade.

4—Probably between 40 and 50 per cent.

Torsion Moment of Motor Shaft

Editor THE AUTOMOBILE:—I want to cut down the weight of a gasoline engine as much as possible. Can I replace a flywheel which is 2 ft. in diameter, the rim alone weighing 200 lb. with a flywheel which is 4 ft. in diameter, the rim alone weighing 50 lb. and get the same results? I am following the law of momentum. Is this correct?

2—If a shaft weighing 12 lb. to the foot has a transmitting capacity of so much power, would it take a shaft of same material weighing 24 lb. to the foot to transmit double power? In other words, is the size of one shaft to another as the powers are which they are to transmit?

3—Does adhesion of driving wheels become smaller or less as the speed of the automobile increases? Why? In other words, does an automobile become lighter to the ground and in what proportion?

4—Have you published anything on the subject of advantages and disadvantages of 12 and 6-volt lighting systems for automobile use in THE AUTOMOBILE? If so, what number of magazine?

5—Comparing engines one of 10-in. stroke, the other of 5-in. stroke and using same quantity gas, leaving other things aside, what would govern speed of engine? Is the expansion of a small volume of gas at a certain temperature the same as a large volume at same temperature?

6—What are the pressures at different points of a lever 100 lb. being applied at A? O. T.

Jersey City, N. J.

—Yes, the laws of momentum are followed.

2—The strength of shafts are not related in the way you state. The beam formula $M = \frac{S\ I}{c}$ can be applied to the shafts as it has a close analogy to the torsion formula, the letter M indicates the torsion moment in this case, S the maximum strength of the material, I, the polar moment of inertia and c the radius of the shaft. In other words the strength of a shaft varies as the polar section modulus.

3—No.

4—Only in reporting discussions of the Society of Automobile Engineers, particularly in June, 1914.

5—The law of gases and their expansion is the same regardless of volume. The valve timing would be the influential factor in regard to speed.

6—The pressure in any point on the lever you show would be equal to 100 lb. times the distance of A to the fulcrum divided by the distance of the point you wish to consider from the fulcrum.

Voltage Not Measured—Amperage Low

Editor THE AUTOMOBILE:—Will you kindly advise me the approximate voltage and amperage of the primary and secondary circuits in a DU 4 Bosch magneto? E. C. P.

Marysville, Ohio.

—Approximate amperage of the primary at 1000 r.p.m. 7 to 8 and the secondary about 1/10. It is impossible to give you an accurate idea of the voltage in the secondary circuit as this varies through a wide range with the speed.

Leak-Proof Rings Take Up Wear

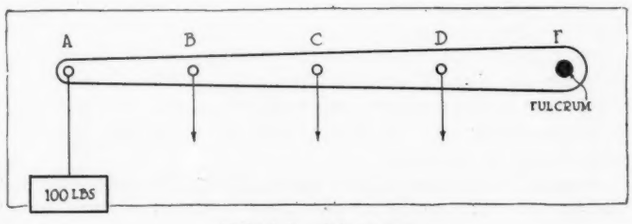
Editor THE AUTOMOBILE:—My engine is worn, I have leak-proof rings. Will these rings, not being fastened in groove, lap in to conform to worn shape of cylinder, or will they shift in groove and retain their perfect circular shape?

Humphreys, Mo. E. H. R.

—If your cylinders are not worn over .005 oversize or out of round the rings should conform very readily and be effective without pinning.

Shorted the Safety Spark Gap

Editor THE AUTOMOBILE:—I am the owner of a model A, E-M-F 30, 1911 automobile. Some mechanic at the repair shop placed a piece of copper wire under the porcelain which supports the copper terminals of the safety gap which is located on the top of the coil box, Splitdorf No. 1745 coil. Not being aware of the above act I tried several times to start the motor, but without success. After considerable trouble and expense I finally located the wire across the terminals short circuiting the safety gap, removed the wire and tried



Principle of leverage

to start motor, but found that I only received a small spark at the plugs. I am writing for information as to what effect on the windings of the coil had the placing of the copper wire across the safety?

2—Would you receive a spark at the plugs with safety short circuited as explained above?

3—What is the object of having this safety? Is it located in the primary or secondary, and how connected? J. B. K.

Kingston, N. Y.

—The shorting of the safety gap by the copper wire would cause no damage to the winding but would prevent the occurrence of the spark at the spark gap of the plug.

2—One terminal of the safety gap is connected to the inner end of the secondary winding and to the grounding terminal of the coil box. The other terminal of the gap is connected to the outer or high tension end of the secondary winding and with the high tension terminal on the box. The object of the safety gap is to protect the winding of the coil when a wire becomes disconnected from a spark plug—the spark in this case jumping at the safety gap instead of at some point inside the winding or within the coil box.

3—Feebleness of spark may be the result of a number of causes. The wiring should be carefully looked over and checked as to its correctness. Loose contacts should be tightened and the contacts within the dash switch should be examined and tested for good contact. Examine the breaker points on the magneto and observe if they open about .025 in. when the engine is cranked. Be sure there is no ground on either leg of the battery. If the cause of the feeble spark is not eliminated by these procedures, the coil with magneto should be examined by a Splitdorf service station.

Putting Vacuum Tank on Fiat

Editor THE AUTOMOBILE:—Kindly advise me how to fit a Stewart vacuum gasoline system on a 15-20 hp. 1911 Italian Fiat, on which the intake manifold is inside the cylinder casting. Also let me know how I may change the oil plate clutch on this car to a dry-plate one, and if this is impossible, please send me names of manufacturers from whom I can purchase a dry-plate clutch for this car.

Menlo Park, Cal. C. H. M.

—Fitting a vacuum system to a Fiat would be rather troublesome, as it would necessitate drilling a hole in the carbureter chamber in the cylinder casting, and this would have to be done in precisely the right spot. It is the kind of job which would be a risky undertaking except if performed by the manufacturers of the engine. You could not get a dry-plate clutch which would fit this car, but you ought not to have trouble with the original clutch, if you use the proper oil and not too much. If you will specify the trouble you are having with the clutch, what oil you use and how much of it, it might be possible for us to help you to obtain the best results from the lubricated clutch.

Fine Spray for Heavy Fuel

Editor, THE AUTOMOBILE:—The use of a hot air intake on a carbureter is a very good idea and so is the use of a hot water jacket around the carbureter. Now why not go still further and make the necessary connections, so that part of the exhaust gases will pass through this same hot water jacket instead of the hot water? This would make the carbureter very much hotter and it would be possible to use very inferior gasoline or even kerosene; or, if this is not practical, how about making a large jacket around the manifold and connecting up this jacket with the exhaust? Has this idea ever been tried out?

In using a mixture of kerosene and gasoline with ordinary carbureter, the engine smokes and carbonizes very badly especially when cold. Would the above idea eliminate this trouble and make it possible to use such a mixture with the idea of reducing the cost of fuel?

Brooklyn, N. Y. E. H.

—Many carbureters have the design to use an exhaust jacket instead of hot water. The principal advantage of the water is that the temperature is more even and there is a slight drawback in the use of exhaust gas, this being that it is liable to throw down sooty deposits so that it is necessary to clean everything out at regular intervals. The chief essentials in using the mixture of kerosene and gasoline are to have a carbureter giving a very fine atomizing spray and to have the intake manifold very warm, it being more important that this should be hot and that the carbureter itself should be so.

Starting Two-Cycle Engine

Editor THE AUTOMOBILE:—I own an American Simplex two-cycle automobile, and although the car is in perfect mechanical condition, I am unable to obtain any service from it because I find it almost impossible to start the motor. In the first place, the compression of this motor is so great that any person of ordinary strength is unable to crank the motor except very slowly. I have overcome this difficulty of fitting the car with a crank giving about twice the leverage obtainable with an ordinary crank. Can you suggest any way to diminish the compression when starting? I have tried cranking with the priming cocks partly open, and even if an explosion is obtained, all the energy escapes through the cocks.

The ignition system comprises a battery and coil, and high tension magneto, and both systems are in perfect condition, and correctly timed. After finally starting, which generally can be accomplished only by towing, the car runs very nicely, developing extraordinary power, showing the carbureter is in proper adjustment. Have you any suggestion to offer that you think will facilitate starting a two-cycle motor? Are all two-cycle motors difficult to start, and if so, what is the reason? After starting, this motor will not run idle without missing, although under load, as I stated above, the motor runs perfectly. Is this a fault common to two-cycle motors?

When shifting from low to second, frequently the gear lever will not slip in unless the clutch is allowed to slightly engage; then the gear slips in and the car proceeds in second gear. Should not the gear slip in with the clutch entirely disengaged, or is this a common occurrence on other cars? I do not have this trouble when shifting from second to high.

I would greatly appreciate any suggestion you have to make, because it seems a pity to scrap this car. If you desire, omit the name of my car when printing this inquiry.

Baltimore, Md. D. M.

—Your difficulty in starting is probably that you cannot get speed enough to compress the charge in the crankcase and get it to transfer into the cylinders without so much condensation occurring that the charge is weakened. It would probably help you if you could arrange to relieve the compression, which could be done by putting a valve in the cylinder about midway of the stroke. Rather careful work would be necessary in fitting the valve, which should be at about midstroke. The object is to have a small valve which is held open by a spring, allowing the first half of the charge to be driven out of the cylinder, so that only the last half is compressed and fired. The valve will close automatically on the firing stroke, but when the engine is started the nut on the top of the stem should be turned so as to bring it down tight on its side.

The difficulty with the clutch may be due to the fact that the clutch stops completely. If it comes entirely to rest the gears on the driving shaft in the transmission will be stationary and it will then be difficult to engage that with the other gears on the shaft which is being driven from the back wheels by the motion of the car. If you have a clutch brake it may be that this is adjusted to be too strong.

ACCESSORIES

H. & N. Carbureter

A FEATURE of this carbureter, which is of the central draft type, is a dashpot balanced annular floating air valve *D*, and integral fuel metering pin *M*, which measures with precision the quantity of gasoline and air required for maximum motor efficiency under all conditions of speed and load. All incoming air travels in a single column, the aim being to produce a perfectly homogeneous mixture, eliminating stratification and loading.

The working vacuum in the chamber *C*, which equalizes the vacuum above and below the dashpot, can be regulated by moving the ball *B* in and out by turning the adjustment screw *S*. Moving the ball in reduces the vacuum in the chamber, allowing the air valve *D* to move up and down more easily and weakening the mixture. Reversing the adjustment, of course, produces the opposite effect. When the correct adjustment has been determined it is fixed by tightening the lock nut *L*.

High Air Velocity

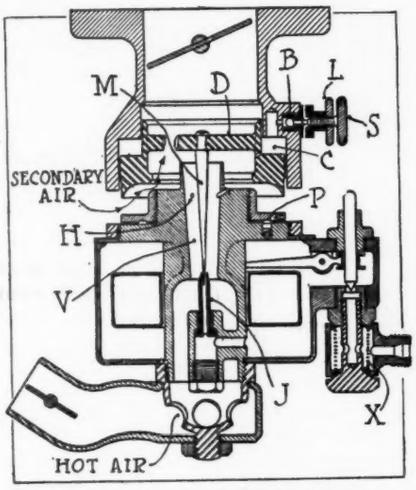
The gasoline jet adjustment is made by turning the threaded ring which forms the base upon which the dashpot rests, raising or lowering the dashpot and with it the metering pin *M*, which varies the jet opening. The ring may be easily turned through a slot. A spring plunger *P* holds the ring in position.

Starting with a cold motor and the present low grade of fuel is facilitated by the extremely high air velocity through the venturi *V*, which has been designed to be scientifically correct. Acceleration is very rapid because of the momentary retarding effect of the variable dashpot on the secondary air intake.

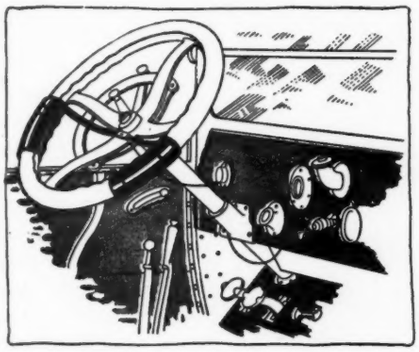
Condensation Prevented

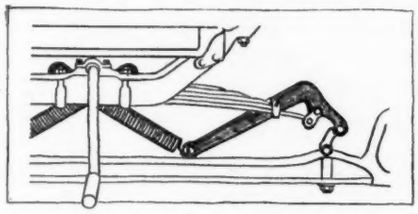
The gasoline enters the float chamber after being strained through the screen *X* and passes through the jet *J* to the venturi where it is mixed with the hot air taken in at the bottom of the carbureter. After leaving the venturi it passes through the mixing chamber, where it is thoroughly mingled with the auxiliary air and passes on to the combustion chamber of the motor. Holes *H* prevent condensation on the walls of the venturi.

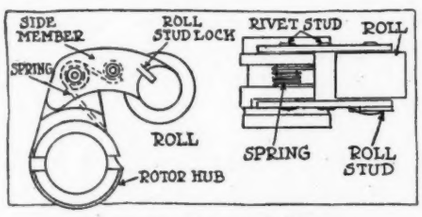
The manufacturers claim that the carbureter produces 1 hp. for every 5 8/10 cu. in. piston displacement in a four-cylinder 4⅛ by 5½ stock motor at 1700 r.p.m. The manufacturer guarantees material and workmanship in the carbureter for one year from the date of purchase and will make repairs or replacements due to defects free of charge if the carbureter is sent prepaid to the factory for inspection. Prices of H. & N. carbureters vary from $12.50 for the ¾-in. size to $100 for the 3-in. size, hot air connections being extra.—H. & N. Carburetor Co., Inc., New York City.



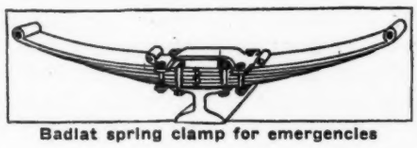
H. & N. central draught carbureter


Mounting of Electric Grip Warmers


Dixie shock absorbers for Fords



Rotor of J. & B. Ford timer


Badlat spring clamp for emergencies

Electric Grip Warmer

Two electrically heated grips are laced to the steering wheel rim, one at each side, and these are connected by a cable which runs down the steering column to the storage battery. When installed on Ford cars, they may be connected directly to the magneto. The equipment includes wiring and switch. Price $4.50.—Electric Heating Element Co., Minneapolis.

Dixie Shock Absorbers

This shock absorber is only for Fords and combines a lever and a long coil spring in its construction. The lever is placed between axle and spring end and the load is carried by the long coil spring. Price, $10 per set of four.—Dixie Mfg. Co., Indianapolis, Ind.

J. & B. Timer for Fords

This special timer is interchangeable with the regular Ford timer. The rotor has a cast hub and a jointed arm carrying the contact roller, the latter being pressed outward by a music wire spring of several convolutions. The roller and studs are of hardened and ground steel; the roller stud is locked so that it cannot rotate in the side members of the arm. A feature of the housing is that it has an oil-hole of sufficient size to permit the insertion of the point of the oil-can spout so that oil will not be slopped; the hole is automatically closed against ingress of dirt. The timer sells for $2.—J. &. B. Mfg. Co., Pittsfield, Mass.

Badlat Emergency Spring Clamp

One of these clamps, it is claimed, will fit and repair any broken spring in ten minutes, no matter where the spring is broken, and after it is applied will not break or bend under the heaviest loads or over the roughest roads. The clamp is of forged steel and the wooden block used is of hard maple with leather face and a suction cup at the center of the block, so that it will adhere to the broken spring. The clamp weighs 7 lb., is 12 in. long, ½ in. thick and 2 in. wide between the bolt lugs. When the spring is broken off at the shackle bolt one of the eyes at the ends of the clamp will fit the shackle bolt, thus rendering the spring serviceable for an unlimited period. The clamp sells for $3.—James Badlat, Archbald, Pa.

The Automobile

PUBLISHED WEEKLY
Copyright 1915 by the Class Journal Co.

Vol. XXXIV Thursday, March 23, 1916 No. 12

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, General Manager
T. B. Van Alstyne, Advertising Manager
231-241 West 39th Street, New York City

EDITORIAL
David Beecroft, Directing Editor
Donald McLeod Lay A. Ludlow Clayden
J. Edward Schipper Sydney Oxberry
L. V. Spencer, Special Representative, Detroit

BRANCH OFFICES
Chicago—910 South Michigan Ave., Phone Harrison 7707
Detroit—95 Fort Street, West, Phone Main 1351
Cleveland—516-517 Swetland Bldg., Phone Prospect 167

Cable Address ---------- Autoland, New York
Long Distance Telephone ---------- 2046 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico ---------- One Year, $3.00
Canada ---------- One Year, 5.00
Foreign Countries ---------- One Year, 6.00

To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order or Register your letter.

The payment of subscriptions will be shown by stamping the date of expiration—the month and year—on the wrapper that carries your paper each week. No other acknowledgment necessary.

Entered at New York, N. Y., as second-class matter.
Member of the Audit Bureau of Circulations.
The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Fuel and the Future

WHATEVER may be the truth as to the necessity for the present price of gasoline, the fact is abundantly clear that the law of supply and demand necessitates a price considerably above that of a few years ago. If the present price is not just it is still obvious that it is merely a matter of time until it becomes just. In other words, the supply of gasoline as originally obtained by very easy methods is lessening.

There are two alternatives. One, which is being developed rapidly, is to find means for making gasoline by processes more elaborate, more troublesome and more costly than the old method of simple distillation. The other is to use heavier oil.

The first procedure offers us ultimately a supply of fuel which may be described as "good gasoline," as this term is usually understood. To establish the necessary cracking plants is going to take time; is going to need expenditure of considerable money; so relief from the present state of affairs cannot come that way quickly, even though its arrival by this road were certain to take place ultimately. There is no doubt about this whatever. There are in existence several cracking processes which enable kerosene to be converted to gasoline. Kerosene today is a drug on the market—it is almost a waste by-product—and commercial common sense will compel its conversion to some useful end.

Meanwhile, however, it is not wise to put off consideration of the direct use of unconverted kerosene in automobile engines. There is no impossibility in a kerosene carbureter, but it will probably be difficult to find a design which will absolutely replace the gasoline type and give exactly the same results. Heat for starting, or some other new function, will be necessary, which means that the automobile user will have some small new thing to learn if he is to utilize kerosene economically.

Hitherto the thing which has acted most against the kerosene carbureter is this very detail: that it cannot be handled *precisely* like a gasoline carbureter. Added to this is the second fact that it is difficult to obtain very slow speeds with the heavier fuel. These things are not serious. To-day the advantage of a much cheaper fuel is sufficient to make it worth while to have a little more elaboration in the carbureter system. The truck, at all events, can be converted easily, for it does not need the same refinement of performance as a high grade touring car.

No Need for Fear

A wide and general use of kerosene has been withheld in the past, largely by reason of the engineer's and manufacturer's fear of putting out anything abnormal. Later developments in automobile engineering have shown that the abnormal is not to be feared as long as it is well tried out before it goes upon the market, and there is absolutely no reason why the same should not be true of the kerosene carbureter.

Electrical equipment has given the careful automobile user, and the majority are fairly careful, a great deal more to keep in proper order. To the necessity for learning to look after something new and strange the average owner has risen capably; why, therefore, should he not do equally well with a kerosene carbureter which would be far less complex than an electrical outfit?

It is sometimes argued that fuel forms so small a proportion of the total cost of running an automobile that a high price does not matter, but this is a short-sighted view. Firstly, it is not true of commercial vehicles, and, secondly, every year sees the other costs of running reduced. Tires cost less than they used to do and will cost still less as weights are reduced and better methods of construction are found. Depreciation grows smaller as prices are lowered, so that a steadily rising fuel price will soon bring the fuel cost up to a position of much greater importance.

Apart from kerosene carbureters, there is another way in which manufacturers can save the ultimate owner of their car a good number of dollars, and this is by making a regular practice of fitting an additional air supply controlled from the steering wheel or steering post. An adequate supply of additional air when used intelligently can increase the miles per gallon nearly 25 per cent on the majority of automobiles. It requires intelligent manipulation of the control, but such handling is not difficult to learn and the accomplishment is very well within the power of any man possessed of normal brain power.

To Cheapen Automobile Fuel

Examination of Sources of Supply Shows Urgency—Need for Improving Cracking Processes and for Kerosene Engines—Problem Not Difficult if Tackled Now

NEW YORK CITY, March 17—The automobile fuel situation was the topic chosen as the subject for the March meeting of the Metropolitan Section Society of Automobile Engineers, held at the Automobile Club of America last night. The importance of the subject drew an audience of about 150 to the meeting, and of these a little over 100 attended an informal dinner given at the club just before the session opened.

The discussion of the experts left no room for doubt that the situation is a serious one, although it also made clear the fact that it is far from desperate. The concluding opinions were that more gasoline would be available by better exploitation of the oil fields, and that, simultaneously, it was highly desirable that automobile engines should be developed and adapted to utilize efficiently a standard kerosene. Kerosene burning seems to be the easiest way to secure a substantial drop in the price of automobile fuel.

E. S. Foljambe presented the paper entitled "The Automobile Fuel Situation," which was in the nature of a review and forecast, with information as to the use of low-grade fuels and suggestions to the automobile industry and the S. A. E. as to the methods best qualified to solve the problem. Among the prominent men who discussed the situation and Mr. Foljambe's paper were Dr. Rittman, inventor of the Rittman cracking process; his associate at the Bureau of Mines, W. A. Williams, who has the title of chief petroleum technologist; Harry Tipper, advertising manager of the Texas Co.; R. H. Johnson of the White Co. and Prof. Charles E. Lucke of Columbia University.

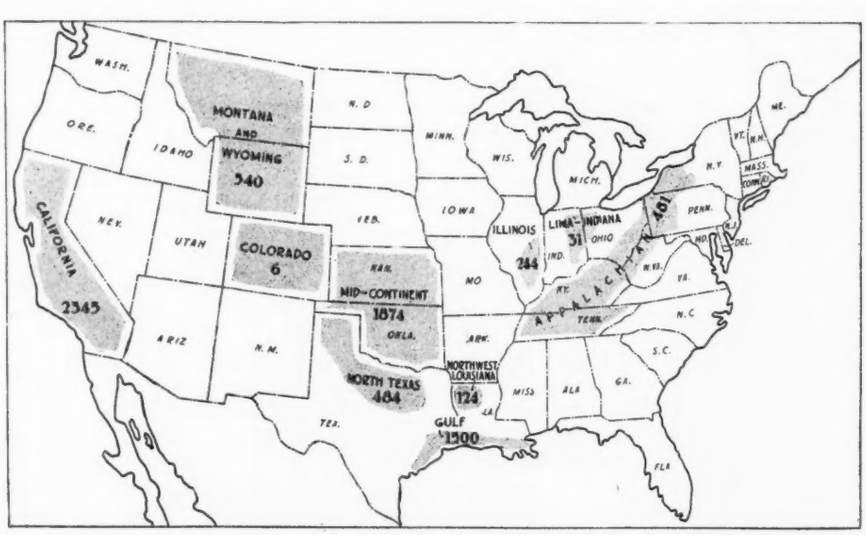
The dinner which preceded the meeting was an informal affair tendered by the Metropolitan Section to Russel Huff, president of the society, and the council. Mr. Huff was the only speaker who was introduced by Leonard Kebler, the chairman of the Metropolitan Section. Mr. Huff spoke a few words of greeting from the Detroit Section of the society and asked the co-operation of the members of the Metropolitan Section in securing a greater enrollment in the S. A. E. for the purpose of furnishing the necessary funds for carrying on the ambitious program which has been entered upon by this year's administration.

Must Use Low-Grade Fuel

The keynote of the evening seemed to be that we are coming rapidly to the point where the low-grade fuels which are now stored or wasted, and in a few cases used for fuel in stationary or similar power plants. must be rendered adaptable to automobiles. Two methods are self-evident to meet this situation, either the present means of vaporization must be so improved as to be able to take care of the lower grade fuels or the fuels themselves must be cracked to form higher grade volatiles.

Mr. Foljambe's paper is a study of existing production, the possibilities of future production and the amount now on hand balanced against present consumption and future consumption if a normal rate of increase in the number of motor vehicles continues. The conclusions he reaches are that we must find better methods of refining the crude in order to produce a larger supply of fuel from the existing supply of crude, that we must create competition in the marketing of fuel products, and furthermore, that vaporizing instruments must be developed which will be capable of using the hydro-carbons of lesser volatility. He turns to the Society of Automobile Engineers as the logical body to solve at least two of the three problems outlined, and states that this situation now ranks in importance to the industry with standardization.

Historically, the paper points out that the first wells were sunk in Pennsylvania in 1859, and subsequently crude oil was used as a medicine and as an illuminant in crude lamps, the oil being used without refining until the time it was discovered that by distillation the products could be separated into high and lower grades of more or less volatility. This distillation led to better illuminating products, but the more volatile liquids were a drug on the market, and for years were turned into the streams until this became a menace to the communities in which the early refineries were located. In 1859 crude sold for $20 per barrel of 42 gal. In 1874 the price of crude had dropped to $3 a barrel. Fluctuations between 1874 and 1914 show the maximum to be $4.23 and the minimum 49 cents.



Showing the distribution of oil in the U. S. A. fields. The figures indicate the comparative amounts remaining to be extracted.

GASOLINE PRODUCED AND EXPORTED IN UNITED STATES

Year	Production, Bbl.	Exported, Bbl.	Difference, Bbl.
1899.....	6,680,000	297,000	6,383,000
1904.....	6,920,000	594,000	6,326,000
1909.....	12,900,000	1,640,000	11,260,000
1914.....	34,915,000	5,000,000	29,915,000
1915.....	41,600,000	6,500,000	35,100,000

Mr. Foljambe pointed out that the actual production of oil at the wells is unknown even to the government, and that so-called production is in reality *marketed* production, there being no authentic record from month to month or year to year as to the amount of oil in storage.

The cause for the increase in price of fuel given by Secretary Lane of the Interior, in his report, is divided into six headings, as follows:

1. Increase in consumption of gasoline in the United States during 1915, 25 per cent greater than in 1914 and a similar increase in 1916.

2. Increase in exports, the figures showing the exports of naphtha and lighter products of 1914 to have exceeded those of 1913 by 500,000 barrels, and the exports for 1915 to have exceeded those of 1914 by 1,500,000 barrels. (No government figures are available since these, but the exportation to Europe continues to increase.)

3. The depletion of gasoline stocks, due to increased domestic and export demands. On Jan. 1, 1915, the refiners' storage stock of gasoline amounted to approximately 2,000,000 barrels. Inquiry at this time indicates that there is little or no gasoline now in storage.

4. Decreased production of crude containing a large percentage of gasoline as partially caused by the falling off in output of the Cushing pool, one of the oldest of the modern wells.

5. Increase in the price of crude oil, from which the gasoline is made.

6. Re financial influences: The recent rapid increase in the prices of crude oil and gasoline have been accompanied by rapid increases in the market quotations of oil company shares. The market values of the capital stocks of thirty-eight corporations, of which thirty-five are in the Standard Oil group and three are typical large independent companies, have increased remarkably in the last six months. The stocks of other oil companies probably show a similar rise, but the quotations are not at hand. The thirty-eight companies selected are believed to represent all phases of the oil industry. These rapid increases might be ascribed to the general condition of prosperity and the general upward trend of the stock market but for the fact that during the last quarter of 1915 the oil company stocks did not rise and fall with the market.

Regarding the conservation question, Mr. Foljambe states that it is necessary to have legislation to prevent increased exportations at high prices, to increase the production of the gasoline from the crude by improved methods and to design smaller engines which will be more economical. For immediate relief it is necessary to develop devices to make possible the use of low-grade fuels.

Regarding alcohol, Mr. Foljambe stated that it gives no hope for immediate relief. The reason for this is that even without governmental restrictions for economical use the present type of automobile engine would have to be entirely reconstructed. Instead of using from 65 to 70 lb. compression for efficient alcohol burning, from 150 to 175 lb. compression is necessary. This at once eliminates it as a fuel for the two million vehicles already in use. New engines could be built, however, were it necessary, which would show, on alcohol as a fuel, practically as efficient performance as with gasoline. The horsepower, however, would be less in proportion as the thermal units per pound or less with alcohol than gasoline. Even present types of engines *can* burn alcohol, but they do so very uneconomically, approximately 50 per cent more fuel being required per horsepower hour than were the engine designed for its use. This puts alcohol out of the present reckoning.

Regarding benzol, the author points out that, although it is prevalent in Europe as a fuel, it can only be obtained in this country in limited quantities. Approximately 14,000,000 gal. of benzol were produced in coke ovens in the United States in 1915 with a possible output of 22,000,000 gal. for 1916. This fuel at present sells for 75 cents a gallon and not lower than 65 cents in 1000-gal. lots. It is in great demand for the manufacture of dyes, explosives and carbolic acid. A ton of coal yields 2 gal. of benzol. As long as the war continues benzol is in as great demand as gasoline, and therefore offers no relief, but in the future may well be considered as a possible part of the fuel supply.

Kerosene Holds Good Prospect

Kerosene holds out prospect of immediate relief, as the production of gasoline has caused an immense over-production of kerosene. The latter fluid is being stored at present in vast quantities and means for the disposing of it are being sought by the refiners, who are resorting to marketing it under special trade names. As a matter of fact, even while theoretically burning gasoline, according to Mr. Foljambe, carbureters have recently been provided to handle a mixture of gasoline and kerosene which on the Baume test is often as low as 54 and practically none of it over 60. Commercial kerosene contains 35 per cent of medium and 10 per cent of heavy kerosene.

The paper states that the Rittman process will yield 200 per cent more gasoline than by any other known method, and also states that, although seven plants are in the United States, none of them is producing any appreciable quantity of gasoline.

Kerosene carbureters were next discussed by the author, who showed several types which have been marketed heretofore, and which involved various means for either breaking up the fuel at the jet, completely gasifying it by heat or even in one case igniting it before it entered the cylinder.

In concluding his address Mr. Foljambe drew the deductions that in view of the phenomenal increase in the automobile industry, its accompanying demand for gasoline, together with the increase in the use of tractors, motor boats, farming machinery and stationary engines, and, furthermore, with an exportation many times that of any previous period, something must be done immediately in order to change conditions.

The remedies he suggests are a control of the distribution, and exportation of fuel either by a tax on exports, as now before Congress in the Britten bill, or by some other method not yet devised; also the improvement and general use of more economical distillation processes, and the development of crude oil fields and oil-bearing shales and the natural gas districts.

Hope in Cracking Process

Shale Oil and Other Low Grade Fuels Can Be Commercially Vaporized by This Method According to Bureau of Mines Expert

DR. W. F. RITTMAN of the Bureau of Mines stated that in investigations he had made he had collected samples of gasoline distilled from the crudes in all the different fields. The difference is amazing, and the variation no doubt explains much of the trouble that has been had in vaporization. One company, for instance, sold four different kinds of gasoline. This concern used kerosene as a base and added casing head gasoline to bring it up to the required grade.

Dr. Rittman stated that he had found automobile designers quite willing to design an engine or carbureter to operate on any kind of standardized fuel. He specifically mentioned some experiments that have been carried on in the Bureau lately with the assistance of C. F. Kettering, vice-president of the Dayton Engineering Laboratories Co., covering these points; the Bureau had supplied the chemical information, while Mr. Kettering had worked out the mechanical side.

"America has not unlimited supplies of fuel," continued Dr. Rittman. "Shale

oil does not hold great possibilities. It is hard to get it, and in Scotland it has only been possible because of the value of the ammonia also obtained; and now that much of this ammonia is being supplanted by methods for extraction from the atmosphere it is going into further disuse. Benzol and toluol are out of the question."

Cracking Saves 5 Cents a Gallon

Dr. Rittman referred to the cracking process as having been developed by Dr. Burton, and stated that if it were not for these processes gasoline would be selling for 5 cents more per gallon than it does now. He predicted that gasoline would continue to rise until the cracking process or the use of kerosene is able to catch up to the demand. The cracking of crude oil is a reality. Great numbers of intelligent men are now working on the problem, and therefore there can only be one result. There are two sides to the question—one is the chemical and the other is the mechanical—and with both chemists and practical mechanical men on the job at the same time, there can be no doubt the solution will soon be reached.

A graphic description of the cracking process was given by Dr. Rittman, who pictured the molecule of crude, stating that the further down in the vaporization scale we go the larger become the molecules. When there is no restraint on this larger molecule it breaks into smaller molecules of *gas*, but by applying proper restraining influences it can be broken into gasoline instead. The reason he gives for operating his process in the gaseous state is that in this condition it is possible to secure any variations of pressure and temperature. There was a time when crude carried the gasoline price, but to-day gasoline carries the price of crude.

In the Rittman process no heat is applied to the liquid itself in the container. The liquid to be distilled, speaking particularly of petroleum, is contained in the feed tank from whch it is fed into the still. There it is vaporized, and the vapor, not the liquid, is then distilled at a temperature of 550 deg. C. and pressure of 250 lb. per square inch.

The new form of still is, generally speaking, cylindrical in shape, and an inlet tube leads into the still from the container holding the liquid. This tube is equipped with a cock by means of which the flow of the liquid (petroleum) is regulated. In the upper part of the still is placed a number of small iron balls, which are heated to a temperature sufficiently high to vaporize the oil as it flows over them from the inlet tube. The vapor thus formed is forced down into the lower portion of the still by the continual formation of more vapor above.

A series of wires, conveying a powerful electric current, are wound about the lower portion of the cylindrical still with resistance coils, which furnishes the heat for distilling this vapor. The heat can be regulated to any desired temperature. The fact that the expansion of vapor under heat is a definitely known equation, whereas nobody ever knows what a mixture of vapor and liquid is going to do, illustrates the value of the gas factor in the new process. Vaporized oil distilled at the above temperature is then passed into the condensing apparatus.

Regarding the matter of competition, Dr. Rittman said that the little fellow has been forced to put up the price simply because he could not afford to store the crude oil and consequently had to pay for it on a rising scale. He predicted, furthermore, that the price may go to 40 cents or only to 35. Regarding the percentage of gasoline which to-day is made by the cracking process, he stated that it did not exceed 15 per cent and consequently was not enough to offset the rising tendency.

W. A. Williams, chief petroleum technologist of the Bureau of Mines, stated that at the present time we have exhausted about one-third of the visible supply of crude. At the present time, of the products manufactured 20 per cent are being exported, 25 per cent are being burnt under boilers and another 20 per cent sold for cost of production. The better use of the remaining two-thirds is the stepping stone to immediate relief. We are producing now 20,000 bbl. less crude than in 1913 and 40,000 less than in 1915. The 1915 production was particularly rich in gasoline, due to the Cushing pool. There are possibilities in Kansas. Two fields have been discovered which have been very productive, although later drillings show less oil than was indicated in the first borings.

Wastage Now Eliminated

Mr. Williams spoke of Mr. Foljambe's reference to waste, and stated that in some places as much as 50 per cent of the crude oil is left in the sand. This wastage is now being eliminated by the use of water and other methods. The wastes in the Cushing field were eliminated largely by improved drilling which enables the operators to secure the crude practically without waste.

Another interesting reference made by these speakers was the possibility of local fields caring for local demand. For instance, the California situation or that of the Pacific Coast can be taken care of by California production. The necessities of the Rocky Mountain district can be met by the production of the Wyoming and Colorado fields, while the big demand of the Eastern States should be met by the great mid-continent fields which produce 75 per cent of the refinable oils.

Casing-head gas, according to Mr. Williams, will probably never amount to more than 10 per cent of our fuel. Probably the cost of this will go up until the supply catches up to the demand, and this is the case throughout the entire gasoline situation.

Kerosene Vaporizer Easy Problem

No Fundamental Difficulty—Needs Careful Application of Principles—Good Atomization and Correct Air Temperature

PROF. CHARLES E. LUCKE of Columbia University spoke of the practical development of means for using the lower grade fuels. According to him the subject of devices of a mechanical nature to meet the problem have been studied intensively during the past few years, and that while hundreds of schemes had been submitted, there is fundamentally no difficulty, and the final results will not differ much from present types. In fact, he expressed himself as being surprised at the delay in reaching some definite conclusion on the problem and stated that in his belief the difficulties to be overcome are, first, unwillingness to take trouble; second, the patent situation, and third, the problem of making a proper mixture of kerosene and air.

Regarding the first, kerosene as a fuel is fundamentally different from gasoline, and therefore fundamentally different means of vaporizing it must be used. "An engine," he stated, "need not start on the first turn, nor yet on the second or third, as long as a satisfactory start is obtained. It is merely a case of changing from the familiar to the unfamiliar."

In regard to the patent situation, there are thousands of devices of all sorts, of which all are defective. In making the final kerosene carbureter it would possibly be necessary to make element A from one patent, element B from the next, and this, of course, renders the situation complex. The final device must be worked out on proper thermo-chemical lines correctly proportioned.

Professor Lucke states his belief that the problem of making a proper mixture of kerosene and air is not difficult. The engine is a variable speed and variable power machine. It is a multi-cylinder engine, and to make a mixture from a single-header equally distributed under all conditions of weather, temperature and density, may seem quite difficult. Practically, however, it is not insurmountable. Such mixtures can be vaporized. Measured supplies of kerosene and air

can be brought together, and by proper heating a dry mixture result. Therefore, the problems consist in arranging a proportioning device and securing the proper temperature. This also is not difficult, for while it is true that the temperature must not be too high or too low the range is not less than 100 deg. Therefore, it is only a question of having first the correct proportion, and secondly, the correct heat supply.

Given these two conditions, the machine will run, but will not perform engine for engine like the power plants of to-day. Car for car, there will be no difference.

An important point brought out by Professor Lucke is the necessity for intimately associated mixtures. An intimate mixture will vaporize at 300 deg. Fahr. readily, while one not so closely intimate under the same conditions will not vaporize at 500 deg. In fact, close to 200 deg. is good enough in some correctly designed headers with proper intermixture. It is simply a question of simple design and of following the laws of vaporization.

Harry Tipper, advertising manager of the Texas Co., stated that in his practical experience he had found plenty of competition in the oil field, and that the market has never agreed. He also stated that the term gasoline was never used by men in the oil business, as it was only a word coined when the more volatile fuels were used for lighting purposes, and never represented a definite cut. Gasoline never meant the same to two companies, while kerosene is a more standardized product. The New York State law requires a definite flash point in an Elliot tester in order that the name kerosene may be used to define the product.

Regarding kerosene, Mr. Tipper said that since it was made when gasoline is made, what can you do with it unless you pay for it with the gasoline? The small refiner suffers and must use the kerosene in order to get rid of it, and he cannot afford to store it.

Fuel Cost Small Percentage

"Do not magnify the part that fuel plays in the cost of running an automobile," said Mr. Tipper. "It is only a small percentage after all. Automobiles were operated successfully in Europe when 35 cents was paid for a gallon of gasoline, and I remember riding in a taxi for 25 cents a mile at that time. Kerosene is the real answer.

R. H. Johnson, president of the New York Dealers' Association, warned against unduly alarming motorists with the predictions of a shortage of fuel in fifteen years. "We do not have to depend on the United States for oil," he said. "Look at the rubber situation, nearly all the crude we use coming from South America. We must remember Mexico, where there are probably the greatest reservoirs in the world, and one well of Mexico has been producing 60,000 bbl. of oil per day for seven years. They have had to cap the wells for lack of facilities for distribution, and several times the production listed in the tabulations in Mr. Foljambe's paper can readily be obtained from the Mexican wells. The Republic of Mexico has enough oil. All it needs is the facility to work the wells."

Dr. Rittman stated that Mexico holds no hope unless it is from the cracking process, but that with this there is room for considerable optimism, since whereas only 5 per cent of the Mexican crude can be refined into gasoline by straight distillation 40 per cent is secured by the cracking process.

Herbert Chase, chief engineer of the Automobile Club of America, suggested that engines may be built on other than the Otto cycle. He pointed out that the Otto cycle is theoretically 35 per cent efficient thermally, whereas in practical motors from 15 to 18 per cent is all that is secured with wide open throttle.

The History of the American Automobile Industry

(*Continued from page* 549)

structures show evidence of much work along these lines. In some cases the air and liquid passed through wicks much as were employed in kerosene lamps. In others, the oil was thrown on several layers of woven wire through which the air was obliged to pass and which wire by its heat absorbed from the flame of combustion quickly vaporized the liquid. The ignition was originally started by applying a torch to a peep hole after a plug had been removed, the plug being quickly inserted thereafter. That the flame might continue from one combustion period to the next a very slight by-pass hole was provided in the inlet valve or near it so that a little fresh air from the air tank continually flowed. This resulted in a little waste of air and fuel during the exhaust stroke, but there would be enough fuel left in the wick or gauze between admissions to burn with this air and keep a small flame alive until the next entrance of air and fuel.

Experience showed that the composite layer of gauzes gave better results if one or more of the wire sheets were perforated so that the air could pass through more freely at the perforated point. This arrangement insured some variety to the mixture, in that it would be more nearly pure air where the perforations were and much more nearly all vapor at the edges of the wire layers where they were held in the cylinder walls and therefore much cooler and more slow in vaporizing the fuel. The result of this arrangement was that it was practically certain a combustible mixture of air and vapor would exist at some point between these extremes and this insured the flame being continuous and the engine certain in operation.

Brayton's engines were frequently built in two-cylinder form and up to 40 hp. Like all engines of that day they were neither high-speed nor lightweight as modern ideas go, but they were really very creditable creations.

In 1873 Brayton arranged with a street car company at Providence, R. I., to apply his engines to one of its cars, but the city authorities refused to allow the car to run on the streets by its own power unless horses were attached to it, so most of the use and testing given the car took place on a short private length of track near a fair ground, after which the experiment was abandoned. In 1876 he licensed Joshua Rose and A. R. Shattuck to make road vehicles driven by his engines.

At Philadelphia a James Fawcett of Pittsburgh, operating bus and hack lines in Pittsburgh, saw the Brayton engine, talked with Brayton and decided to equip an omnibus with this form of power, which was done in 1878. The first form of transmission being a hydraulic one and proving unsatisfactory, the engine was remounted with shaft projecting toward the rear and with bevel gear to drive a cross-shaft. A friction clutch and reversing arrangement were also provided, but like the street car, the project had to be abandoned because the city authorities would not permit its use.

British Prohibit Car Imports

No More Passenger Cars To Be Shipped To the British Isles for the Duration of the War

LONDON, March 21—At a meeting of the Privy Council, King George signed a proclamation prohibiting the importation of automobiles, motorcycles and various other articles. This prohibition has been expected for several weeks, and it is understood that the purpose is mainly in order that shipping may be free to carry necessaries for which the need is urgent. It is in logical sequence to the imposition of the 33 1/3 per cent duty placed upon automobiles by the British government last October. Full information is not yet available, but it is understood that the prohibition does not apply to motor trucks or vehicles to be used solely for commercial purposes.

The immense effect of this decree upon the British industry is difficult to appreciate. It will bear very heavily upon the numerous dealers who have existed for the past year almost entirely by the sale of American automobiles. If the prohibition is maintained for twelve months or more, several of the big London agencies will be forced to close down. It will mean almost complete stagnation in the highly-developed British branches which are maintained by several of the larger American manufacturers.

Regarding the other side of the question, prohibition of imports is bound to have the effect of starving the market, which means that when the ban is removed there will be a tremendous rush to obtain cars, and it will probably be difficult to export them fast enough for months after the imports are made free again.

Four Changes in Timken-David Brown Staff

DETROIT, MICH., March 17—Several promotions are announced by the Timken-David Brown Co., manufacturer of worm-drive axles:

Engineer C. T. Myers is promoted manager of the company.

F. T. Zollinger becomes assistant manager, in charge of purchases, sales, receiving, shipping and accounts.

C. S. Dahlquist becomes general superintendent in charge of manufacturing.

M. Voelk is made general foreman and Mr. Taylor assistant engineer.

United States Rubber Elects E. B. Davis a Director

NEW YORK CITY, March 21—The annual meeting of the stockholders of the United States Rubber Co. was held in New Brunswick, N. J., today. Edgar B. Davis of Brockton, Mass., was elected a director. Mr. Davis is vice-president of the General Rubber Co.

The directorate now consists of eighteen, M. Bun and A. L. Kelley, former directors, having died during the year. The directors are as follows: W. S. Ballou, J. C. Brady, M. F. Brady, M. S. Burrill, S. P. Colt, H. E. Converse, E. B. Davis, James Deshler, J. B. Ford, F. L. Hine, H. L. Hotchkiss, Lester Leland, S. M. Nicholson, R. B. Price, H. E. Sawyer, W. H. Truesdale, T. N. Vail and E. S. Williams.

Saxon Six Price Raised to $815

DETROIT, MICH., March 18—Beginning to-day the Saxon Motor Car Corp.'s six-cylinder roadster and touring car will sell at $815 instead of $785. The reason for the increase in price is stated by officials to be due to the increased expense of manufacturing the car.

Koehler Truck Price Raised to $955

NEWARK, N. J., March 17—On account of the advance in price of materials the H. J. Koehler S. G. Co., this city, has raised the price of its Model K four-cylinder 1-ton truck, complete with body, to $955 and the chassis to $940, f.o.b. Newark. The former price of the chassis was $870.

E. R. Hall Dies Suddenly

MT. CLEMENS, MICH., March 17—E. R. Hall, experimental engineer to the Goodyear Co., died here to-day, having recently come to this city in the hope of recovering from an illness with which he had been afflicted for some time. Mr. Hall was a member of the Council of the Society of Automobile Engineers and a native of Somerville, Mass. Born in 1885, he was educated at the Massachusetts Institute of Technology and joined the Goodyear Rubber Co. on Sept. 1, 1908. His appointment as technical expert for the company was made in February, 1909. Since then the experimental development of Goodyear tires had been in his hands.

Mr. Hall's appointment to be a councillor of the S. A. E. was made in January of this year. He will be deeply regretted by his associates in the Goodyear Co., all of whom held him in the highest esteem.

Nehrbas Heads Premier Production

INDIANAPOLIS, IND., March 18—F. P. Nehrbas has joined the Premier Motor Corp., this city, in the capacity of production manager. Mr. Nehrbas has been in the automobile field since 1910, when he became factory manager of the E. R. Thomas Co. Later he joined the American Locomotive Co., Providence, acting there as works manager.

England May Curtail Gas Supply

Move on Foot to Prohibit use of Automobiles Except for Business Purposes

LONDON, ENGLAND, March 8—Claiming that gasoline must be economized, the British authorities are about to take possession of all stocks and control all sales to the public. Under this scheme the commercial vehicle users, and the army and navy, will have a preferential call, followed by doctors and other professional men. Private motorists will come last.

It is not known exactly how the details of the scheme will be worked out, but it appears probable that gasoline tickets will be issued by magistrates and judges, and that all automobile owners will have to make personal application to these authorities. Each case will be judged on its own merits and it will be decided whether the motorist is eligible for a supply of gasoline, and what quantity shall be allowed him. It is believed that those who have definite business to perform with an automobile will not suffer any great inconvenience, while those car owners who wish to drive for pleasure only will find that such a course is impossible.

In general the scheme is calling forth opposition. It is the opinion among English motorists that there is very little use of automobiles for purely pleasure purposes. The general tightening effect of the war has in itself been sufficient to stop all luxury use of cars. It is also claimed that such a scheme as proposed by the government will be very difficult of application, for it is hard to prove what is justifiable and what unjustifiable motoring. Local magistrates, too, usually possess very little knowledge on motoring matters and will not be competent to estimate the amount of gasoline different types of automobiles should consume for given distances.

This week official posters have been placed on the walls inviting the public to make as little use of automobiles and motorcycles for pleasure purposes as possible.

Walsh Briscoe Advertising Manager

JACKSON, MICH., March 18—R. T. Walsh has been appointed advertising manager of the Briscoe Motor Corp. Mr. Walsh is one of the best known men in the automobile advertising field. For several years he was advertising manager of the Maxwell Motor Co., and previous to this connection he was assistant advertising manager of the Ford Motor Co.

Edmunds & Jones Issue New Stock

$1,000,000 of 7 Per Cent Preferred and 5000 Shares of Common Offered

NEW YORK CITY, March 21—A syndicate of New York bankers is offering $1,000,000 of 7 per cent cumulative preferred and 5000 shares of common stock of the Edmunds & Jones Corp., the new corporation combining the Edmunds & Jones Mfg. Co., the Canadian Lamp & Stamping Co. and the Chicago Electric Mfg. Co. The syndicate, which is headed by White, Weld & Co., Hornblower & Weeks and Merrill, Lynch & Co., offers the 10,000 shares of preferred at 97, two shares of the preferred carrying the privilege of subscribing to one share of common at $30. The authorized issue of the common is 40,000 shares.

It is provided that at least 20 per cent of the surplus profits each year, after the payment of preferred stock dividends, shall be used to acquire and cancel at not more than 120 and accrued dividends the outstanding preferred stock. It is stated that net earnings for 1915 of the three companies are reported in excess of six times the amount required for the preferred stock dividend and combined sales for January and February are reported as more than 100 per cent greater than in the same period of 1915.

The combined balance sheet of the three concerns which make up the Edmunds & Jones Corp. shows that on Jan. 1, 1916, assets totaled $1,315,541.18, made up as follows: cash, $208,075.15; accounts receivable, $264,184.19; merchandise, $339,914.15; real estate, plants machinery, $503,367.69.

Liabilities consisted of current accounts, $114,602.24 on bills payable; preferred stock, $1,000,000 and surplus, represented by 40,000 shares of common stock of no par value but estimated at $200,938.94.

Of the earnings in 1915, those of the Edmunds & Jones Mfg. Co., totaled more than $360,000, and those of the two other concerns amounted at more than $80,000, a total of over $440,000.

—

Wilson Truck Offers Stock

DETROIT, March 20—The J. C. Wilson Co., which recently increased its capital stock from $20,000 to $225,000, is offering for sale $100,000 of its common stock at a par value of $10 per share. The company makes the Wilson truck and is now preparing for greatly increased production.

The assets of the company total $174,691 and the direct liabilities $42,587, including a mortgage of $25,000. The size of the property owned by the concern is 107 by 588 ft. and partly 142 by 670 ft. The three main factory buildings consist of a three-story structure 51 by 150; a two-story building 90 by 170; another two-story building 33 by 170 ft., and several smaller structures.

Besides making trucks the J. C. Wilson Co. has been a manufacturer of auto tops and has done general trimming since 1908, when the company began operations.

—

San Francisco Awards Cause Discord

SAN FRANCISCO, CAL., March 15.—That considerable discontent has arisen in connection with the awards in the motor vehicle and accessory department of the transportation exhibit at the recent exposition held here, is apparent from the rumors which have leaked out to the effect that Group Jury 101 which was appointed by the exposition management to specifically make awards in the automobile section of the transportation department, has been discredited in that its findings were materially changed after they were filed with the exposition authorities. It seems that not only have some of the awards made by Group Jury 101 been changed but that additional awards, not included in the regular schedule, have been created. The feeling is gaining headway that the great benefit, which should acrue to any exhibitors in connection with an exhibition of such magnitude, has been very materially reduced because of upsetting the findings of the jury originally selected to make the awards, and also because of the fact that adding additional awards has naturally robbed those primarily intended of much of their intrinsic value.

—

Want Changes in Ariz. Registration Law

PHOENIX, ARIZ., March 18—In his annual report for 1915, Secretary of State, Sidney P. Osborn emphasizes the necessity for vital changes in the Arizona motor vehicle registration law.

The cost of a license for a car of less than 25 hp., A. L. A. M. rating, is $5, and it is $10 if the engine has greater rated horsepower. Osborn says that this is unfair to the owners of old cars that are worth only a fraction of the prices paid for new models, and recommends that provision be made for a sliding scale of reductions on cars that have been in use over two years.

When the year is half over, half the regular charge for a license good till the first of the following year, is charged. Osborn thinks that a reduction of 25 per cent should be made after the close of the first quarter, and of 75 per cent after the third quarter.

Perlman Secures Two Plants

Perlman Co. Stated to Be Able to Supply All Demands of Industry

NEW YORK CITY, March 21—Following the announcement of the formation of the Perlman Rim Corp. in THE AUTOMOBILE for March 16, comes the statement of L. H. Perlman, president of the new company, that two plants have been secured and are already manufacturing demountable rims and two other factories are under consideration subject to investigation as to the value of the property. Officers of the Perlman company state that the concern is in a position to supply all demands of the car manufacturers, since if present plant facilities are inadequate, in spite of the addition of other factories, contracts will be let to other manufacturers.

In connection with the financial backing of the Perlman company, which is being financed by L. G. Kaufman, president of the Chatham and Phenix National Bank, it is stated that W. C. Durant is interested in the new enterprise.

The Standard Welding Co. has applied to the court to temporarily suspend the injunction until uncompleted orders can be filled, and also is seeking to have the mandate modified. The matter will come up in court on Friday. The company has several demountable rim constructions under consideration and its officials state that if forced to abandon the manufacture of demountable rims, the company's tubing and tube parts business will be greatly augmented.

—

To Pass on Sale of Bock Bearing Assets

TOLEDO, OHIO, March 18—A special meeting of the stockholders of the Bock Bearing Co. will be held on March 28 at the company's office in West Toledo, for the purpose of considering and taking action upon the proposed sale of the entire property and assets of that company.

—

Pierce-Arrow Machinists Back at Work

BUFFALO, N. Y., March 21—The plant of the Pierce-Arrow Motor Co., this city, was opened to-day after being closed on March 2, on account of a lockout, following a strike of machinists.

—

Maxwell Owners Offer Cars to Army

EL PASO, TEX., March 18—Owners of 140 Maxwells, living in and around El Paso, have offered their services and cars to General Pershing of the U. S. Army, for use as he sees fit in any movement of troops. The owners have all signed an agreement to place their cars at the disposal of the army.

S. A. E. Standards Meeting April 21

Cleveland Chosen as Meeting Place—Standards, Council and Section Meetings

NEW YORK CITY, March 18—At the meeting of the Council of the Society of Automobile Engineers held this week it was decided that the next general meeting of the Standards Committee should take place in Cleveland on April 21. It is laid down in the rules that the two meetings of the Standards Committee, which take place between the general meetings of the Society, shall be held on the second Thursday in April, and the second Thursday in October. Seeing that the Cleveland section has an important paper on carbureters by F. O. Ball scheduled for Friday, April 21, the Council thought it advisable to alter the date of the Standards Committee meeting so that a two-day session could include standardization work, the council meeting ing and the Cleveland section paper.

On April 20 three or four of the standards divisions will meet in Cleveland and the council will meet in the afternoon. It is expected that the whole of April 21 will be devoted to the discussion of standardization work, and a prominent subject will be further consideration of automobile lighting with particular reference to glare.

It is expected that practically all the divisions of the Standards Committee will hold meetings previous to the general meeting and the general meeting of the committee will have to consider a number of important matters. The nomenclature work is progressing very rapidly, and it is hoped to have this completed and ready for submission to the society at the summer meeting on board the Noronic.

A tabulation is at present being made showing the very extensive use of S. A. E. standards by automobile manufacturers and, although this is not completed, results to date show that acceptance of the more important standards is almost universal.

J. H. Utz, chairman of the Miscellaneous division, is arranging many of the details of the Cleveland meeting, and it is anticipated that the attendance will be very large.

—

Electric Storage Battery Has Gross Sales of $1,770,188

PHILADELPHIA, PA., March 18—The Electric Storage Battery Co., this city, for the year ended Dec. 31, 1915, had gross sales of $1,770,188, as compared with $1,395,793 in 1914. The 1915 income, amounting to $1,360,748, was equal to 8.37 per cent on $16,249,425 capital stock, compared with $1,103,237 in 1914, which was equal to 6.78 per cent on $16,250,000 stock. The surplus, after dividends, was $710,784, compared with $453,273 in 1914. The balance sheet showed $653,756 cash on hand and a reserve of $1,081,201.

The retiring directors were re-elected at the annual meeting in Camden, N. J. The board will meet for organization on Wednesday, April 5.

—

25,000 Cadillac Eights Shipped

DETROIT, MICH., March 22—On March 16 the Cadillac Motor Car Co. shipped 25,000 Cadillac eights. This quantity has been produced since the company commenced manufacturing this model, October, 1914. They state that the twenty-five thousandth car would have been shipped earlier had more freight cars been available.

—

Overland Shipments Total 27,685 in First Two Months

TOLEDO, OHIO, March 18—Shipments of Overland and Willys Knight cars for the first two months of 1916, totaled 27,685 as against 10,240 for the corresponding months of 1915. During January, 1916, 12,393 cars left the factory, as compared with 4613 for the same month of 1915. During the whole month of February, 1915, 5627 Overland cars were shipped, while this year, this total was exceeded by 500 at the 18th of the month.

—

Fiat Patent Case Settled

NEW YORK CITY, March 21—The suit of the Fiat Co. against the Olds Motor Works, charging infringement of design patent No. 48,219, covering a radiator and hood design, has been settled out of court by the payment of back damages and the agreement of the Olds company to discontinue the manufacture of the design in question. The patent in the suit, wihch was in the U. S. district court for the southern district of New York, was issued Nov. 30, 1915, to Carlo Cavalli, Turin, Italy, who assigned it to the Fiat concern.

—

Bull Resigns as Cole Assistant Engineer

INDIANAPOLIS, IND., March 16—A. A. Bull has resigned as assistant chief engineer of the Cole Motor Car Co., this city. Up to the present time he has made no other connection.

—

Morgan & Wright Enlarge

DETROIT, March 18—The plant of Morgan & Wright, the automobile tire makers, was recently enlarged by two stories, giving the plant 45,000 additional square feet of floor space.

At present 3000 men are employed, but the force is to be gradually increased to 4000 or more. Production is also to be increased to 10,000 tires daily.

S.A.E. Summer Trip Details

Officials Appointed to Take Charge of Various Activities—June 12 Busy Day

DETROIT, March 17.—Official headquarters for the Society of Automobile Engineers, previous to sailing from Detroit on its annual summer cruise, June 12-16, have been arranged for at Hotel Ponchartrain at this city. R. O. Gill, in charge of hotel arrangements has contracted for the ball room floor for Monday June 12. Up to sailing time of the Noronic at 2 p. m. all business of the S. A. E. will be transacted in this headquarters. A complete staff of officials to care for every need of S. A. E. members reaching the city on the morning trains will be on hand. Plans have been evolved for a committee in charge of W. B. Stout to care for all baggage of members sailing. A members' luncheon will be served in the ball room and each of the six S. A. E. sections will maintain headquarters in the ball room previous to sailing.

The volume of work incidental to handling a summer cruise of 550 engineers on the Great Lakes is nearly as large as staging a national convention to nominate a presidential candidate. The 1916 meetings committee, which has entire charge of this work, has nearly completed its organization to handle the various work, and its organization follows:

Purser and accounts—S. B. Dusibberre.

Transportation and baggage—W. B. Stout.

Hotel headquarters—R. O. Gill.

Papers for summer session—K. W. Zimmerschied.

Daily S. A. E. on boat—D. Beecroft.

Automobiles for factory visits—J. G. Vincent.

Badges and Souvenirs—K. W. Zimmerschied.

Wireless service—W. A. Brush.

Music and entertainment—C. W. Terry.

Treasurer W. H. Conant has complete charge of tickets and reservations.

S. A. E. members reaching Detroit, Monday morning, June 12, will have an opportunity of visiting the different motor car and other factories. Cars will be at the hotel at the convenience of members for this purpose. Other cars will be furnished for sight-seeing parties of ladies.

—

—J. D. Kaufman, who for the past several years has been sales representative for the American Die & Tool Co., Reading, Pa., has been appointed sales manager of that company.

Chicago Amateur Race Popular

Many Sportsmen Arrive for Practice on Chicago Speedway—Some Fast Laps Made

CHICAGO, March 20—That there will be a large entry list for the interclub professional drivers' race at the Chicago speedway, May 20, seems to be indicated by the number of amateur enthusiasts that were out for practice with their cars on the board oval yesterday. This was the first regularly observed practice for the unique event, and there were a total of fourteen of the Chicago sportsmen testing the speed possibilities of their mounts. Three weeks ago there was an informal practice staged and on the two days of practice there have been eighteen different cars on the track with amateur pilots at the wheel.

The best time made so far in practice is credited to A. W. Bronstedt, whose Mercer turned a lap in one minute and 36 seconds. This is a speed of 76 miles an hour.

The race as planned is an invitation affair and is open only to amateur drivers who own their cars and are members of some of the leading clubs of Chicago and vicinity. The invitations are extended through the clubs and the cars run under club colors. The mechanic as well must be an amateur and a fellow club member of the driver.

The qualifications committee of the speedway has drawn up the basis for the extending of invitations. According to these supplementary regulations the race will be limited to two, three or four-passenger roadster bodies on roadster chassis, as indicated by the manufacturers' catalog, and motors, while they may be of any piston displacement, providing the bore and stroke is the same as catalogued, and must be of the same general design as cataloged, may be altered as to ignition and carburetion equipment, lightening of piston and connecting rods, changing valve sizes and lifts, changing of timing, lubrication, fuel feed, a full electrical equipment must be carried with the exception of lamps, but may be disconnected electrically and mechanically, so as to take no power.

—

Corona Grand Prize Expects Twenty Starters

LOS ANGELES, CAL., March 20—The Corona Grand Prize, which the Citrus Belt Racing Association is promoting and which is scheduled for April 8, promises to eclipse all other California speed carnivals and is expected to be the greatest motor meet in the history of the sport in the West.

There will be twenty starters; and many of the drivers claim that all twenty cars will show a speed of 100 miles an hour in the elimination trials, which will be held on the Grand Boulevard the week before the great race. Practically all of the prospective entrants declare that not only will the record established by Eddie Pullen on the Corona course last year be boosted in the speed clash this year, but also that in order to qualify as one of the twenty speediest contestants an entrant will have to pass the century mark in the preliminaries.

The hour for the race has been changed from what it was last year. When the meet was held on Thanksgiving Day the days were so short that it was necessary to begin the race early in the morning in order that visitors would have time to get back to Los Angeles and other southern California points. This year the contest will start at 1:30 o'clock in the afternoon.

There will be one grandstand this year, but it will be large enough to accommodate thousands of people. Instead of having the official stand at the upper end of the course, as heretofore, it will be placed on the lower end near the depot.

In addition to the guaranteed cash prize of $12,000, the Flagler trophy, which is valued at $1,000, will also go to the winner.

—

Speedway for Birmingham

BIRMINGHAM, ALA., March 18—The Birmingham Motor Speedway Co. to-day awarded a contract for a 2-mile speedway around the lake of the Birmingham Motor and Country Club. The road will cost $500,000. August Herrmann of Cincinnati is president of the speedway company.

—

Three Duesenbergs for Indianapolis Race

INDIANAPOLIS, IND., March 17—The first three official entries made for the Indianapolis Speedway 300-mile race this year were made by F. S. Duesenberg for three Duesenberg cars, to be driven by O'Donnell, Henderson and D'Alene.

—

Wilcox Quits Racing to Market Automobiles

INDIANAPOLIS, IND., March 18—Howard Wilcox has announced his retirement from automobile racing. He has entered the automobile dealers' field, with Don Herr, as State distributer of Case and White cars. He has been in the racing field for nearly seven years. Wilcox states that he is going to drive in one more race, but only because he has given his word to do so. The Rotarians in Indianapolis will hold a meeting in the fall, and as an entertainment a special race will be staged on the local speedway.

Wyman & Gordon Reorganized

Capital Now $3,000,000 — No Change in Policy—Large Factory Extensions Under Way

WORCESTER, MASS., March 20—The Wyman & Gordon Co., manufacturers of drop forgings for the automobile trade has reorganized with a capial of $3,000,000 and changed its name to Wyman-Gordon Co. This reorganization does not mean any change in the policy of the company, but incorporates new interests represented by Robert F. Herrick, Boston, well known in business and financial circles because of his large investments in varied lines. Due to this reorganization and new capital large factory extensions are under way, these including a separate building housing a heat-treating department. In addition the factory enlargement will accommodate a new inspection department as well as added facilities for testing and laboratory work. A modern administration building is being built. These additions will permit of a large increase in the forge department.

The control and management of the company will continue with those who have been associated with it. The officers are: George F. Fuller, president; H. G. Stoddard, vice-president and treasurer; and Chas. C. Winn, assistant treasurer.

—

A. P. Warner Enters Trailer Trade

CHICAGO, ILL., March 21—A. P. Warner, founder of the instrument company, has re-entered the automobile industry, becoming head of the Warner Auto Trailer Co., Beloit, Wis., manufacturing commercial trailers and "Twentieth Century" prairie schooner trailers for touring. The Warner company has purchased the old Thomson plant in South Beloit, which has a capacity of 100 trailers a day. Equipment of prairie schooner trailer includes waterproof khaki duck tent, two berths, stove, table, ice chest, etc.

—

Marmon Increases Price $200

INDIANAPOLIS, IND., March 21—Owing to the increasing cost of material and of labor, The Nordyke & Marmon Co. announces an advance in price on the Marmon models 3 and 4, this advance to be effective immediately. Two hundred dollars has been added to the price of each model, bringing the five-passenger car to $2,900, the seven-passenger car and the three and four-passenger roadster to $2,950.

—

MUSKEGON, MICH., March 18—The Campbell, Wyant & Cannon Foundry Co., has increased its capital stock from $150,000 to $400,000.

Solid Tire Suit Ends

Court of Appeals Affirms $210,000 Judgment Against Diamond N. Y. Co.

NEW YORK CITY, March 21—The handing down, on Friday last by the Circuit Court of Appeals, sitting in New York City, of a decision against the Diamond Rubber Co. of New York in favor of the Kelly-Springfield Tire Co., and unanimously affirming the decision of the Lower Court, awarding Kelly-Springfield approximately $210,000 damages against the defendant for infringement of the Grant patent, marks the beginning of the end of a patent litigation that has become famous.

This litigation arose over Grant Patent No. 554,675, issued Feb. 18, 1896, to A. W. Grant, for improvement in solid rubber tires. It expired Feb. 18, 1913. This is the patent covering the internal wire Kelly-Springfield solid rubber tire. The litigation has extended over a period of twenty years and the books are full of decisions concerning it. The first suit was decided in December, 1898, in favor of the patent, by the Federal Court in New York City.

In 1901, Judge Wing, in Cincinnati, also found the patent valid; but the Court of Appeals for that Circuit reversed the Lower Court and found the patent void. The Supreme Court refused to take the case on appeal; thus the patent stood valid in the East and void in the Middle West.

In 1906, the question of validity was before the court in Milwaukee, and the patent was there held valid, notwithstanding the decision against it by the Circuit Court of Appeals in Cincinnati. In the same year, the trial court in New York again declared the patent valid and, finally, the Circuit Court of Appeals in New York and in Milwaukee affirmed the decision of the lower courts.

In June, 1907, the Diamond Rubber Co. of New York was sued and the merits of the patent came before the court on ten different occasions in this suit and each time was decided in favor of the patent.

Because of conflicting decisions, the Supreme Court allowed an appeal in the Diamond case, and in 1911 supported the contention of plaintiffs, declared the patent valid and the defendant to infringe. The defendant then refused to pay on the ground that it had made no profits and that plaintiffs had sustained no damages.

The accounting proceeded at great length and the master finally reported that plaintiffs were entitled to 5 cents a pound on all rubber that the defendant had sold.

An application then was made to increase these damages and for the allowance of interest. Judge Hand, sitting in the District Court of New York, allowed $50,000 smart money and $27,000 interest, which, together with costs, resulted in a judgment against the defendant for approximately $210,000.

In the meantime, numerous other alleged infringers have been prosecuted and several suits are now pending in the accounting stage. In one against the Republic Rubber Co., Youngstown, Ohio, the Master has awarded the plaintiffs $115,000, being at the rate of 5 cents a pound; and also in a case against the Goodrich company an award has been made on the same basis, amounting to $262,000 in favor of the Kelly-Springfield company.

The decision just handed down is particularly important to patentees, as it firmly establishes a new measure of damages in this class of cases; or, rather, firmly establishes an old measure of damages that had been hesitatingly advanced and had practically been discarded.

Formerly, a successful plaintiff in a patent case was limited either to the profits made by defendant or to such damages as could be distinctly shown, measured by license fees, loss of sales or forced diminution of price.

The measure of damages invoked by plaintiffs in the Diamond case was that a uniform license fee had been established; and also that they were entitled to recover what was reasonable as a royalty.

—

Waite Tractor Moves to Elgin

ELGIN, ILL., March 18—The Waite Tractor Co., late of Chicago, has removed to Elgin, Ill., and has commenced operations in the Magnus Building, River and Kimball Streets. The Elgin Commercial Club has given the company a bonus of $1,000 and rent free for one year. In the past the company has contracted for the manufacture of its machine, but recently decided to establish a plant of its own and manufacture its product itself. The tractor can develop a speed up to 15 m.p.h., and can be utilized for farm machinery power as well as field or road work. Twenty-five men will be employed at the outset, and machinery is now being installed.

—

Quality T. & R. Co. to Change Name

HARTVILLE, OHIO, March 20—At a meeting of the stockholders of the Quality Tire & Rubber Co., this city, April 8, the name of the firm will be changed to Besaw Tire & Rubber Co. The new name is given for C. A. Besaw, president. C. A. Besaw, J. C. Harmony, F. E. Schumacher, Hiram Carper, G. E. Munk, Oliver Brumbaugh and M. J. Herr are directors.

Approve Uniform Service

A.S.M.A.M. Think Manufacturers Should Adopt Standard Service Plan

DETROIT, March 18—Not only are the members of the Automobile Service Managers' Association of Michigan in favor of the adoption by the manufacturers of a uniform or standard service plan, but local automobile distributors and dealers approve the idea and are hoping that an understanding will soon be reached for the adoption of such a plan.

At the meeting held at the Hotel Statler, March 16, a plan was outlined and approved by those present from the service mangers' association. The matter has been taken up with General Manager Alfred Reeves of the National Automobile Chamber of Commerce, to be taken up by him with the members of the chamber.

—

Souther Leaves Ferro

CLEVELAND, OHIO, March 20—Henry Souther, vice-president of the Ferro Machine & Foundry Co., and past president of the Society of Automobile Engineers, has just severed his connection with the Ferro company. Mr. Souther joined Ferro early in 1914, having been consulting engineer to the Standard Roller Bearing Co., Philadelphia, Pa., for the previous four years.

Souther's knowledge of metallurgy is varied and extensive, his business and professional career commencing with the Pennsylvania Steel Co., which he left in 1893 to become engineer for the Pope Mfg. Co., Hartford, Conn. In 1899 he opened an office at Hartford as a consulting engineer, and it was in this capacity that he became prominent in connection with the automobile and allied industries. He was consulting engineer for the Association of Licensed Automobile Manufacturers during the life of that organization and was president of the Society of Automobile Engineers during 1911.

—

Tractor Show for Northwest

OMAHA, NEB., March 22—A tractor-show circuit embracing some seven or eight cities of the best agricultural section of the Northwest has been definitely decided upon, and plans are rapidly nearing completion. The newly-formed circuit will be under the supervision of A. E. Hildebrand of Omaha, whose work will be directed by a committee representing tractor manufacturers.

Nearly 50,000 people attended the tractor show held in Fremont, Neb., last year, and this city will probably be one of the first places selected.

January Exports $8,262,434—Trucks Total $3,416,818—Cars $3,044,995

January, 1915, Total $4,473,865—January, 1916, Shows Gain of Over 84 Per Cent—Exports During Seven Preceding Months Total $66,822,383

WASHINGTON, D. C., March 18—According to statistics compiled by the Department of Commerce, 1269 commercial cars, valued at $3,416,818; 4520 passenger cars, valued at $3,044,995, and $1,800,621 in parts, not including engines and tires, were exported in January last. During the seven months ended January, 1916, the exports amounted to 12,391 commercial cars, valued at $32,559,354; passenger cars to the number of 27,376, the value of which was $21,471,078, and parts, not including engines and tires, to the value of $12,791,951.

During the corresponding periods of last year the exports were as follows: January, 1915: Commercial cars, 935, valued at $2,545,527; passenger cars, 1803, valued at $1,313,153; parts, not including engines and tires, $615,185. Seven months ended January, 1915: Commercial cars, 3972, valued at $10,989,442; passenger cars, 6904, valued at $5,808,099; parts, not including engines and tires, $2,789,246.

The United Kingdom's purchases of cars in January last numbered 1090 machines, valued at $1,718,886, while during the seven months' period the number was 13,571 machines, valued at $18,614,667. In January a year ago 1389 cars were shipped there, the value of which was $1,770,966, while during the seven months ended January, 1915, the number was 3448 and the value $4,758,702.

Shipments to France in January last amounted to 521 cars, valued at $1,358,115, while during the seven months' period the number was 3172 and the value $7,993,295. During January a year ago 236 cars were shipped to France, the value of which was $527,869, while during the seven months' period the number was 2024 and the value $5,017,488.

There were no exports of cars to Germany either in January last or during the seven months' period of this year. None was shipped in January a year ago, while during the seven months' period of that year sixteen cars, valued at $17,364, were exported to the Kaiser's land.

Russian Figures Large

One hundred and fifty-one cars were exported to Russia in January last, the value being $338,324, while during the seven months' period the number was 3261 and the value $12,824,047. There are no statistics available for the corresponding periods of last year.

Denmark is another European country that is now figuring in our automobile export trade, 105 machines, valued at $80,687, being shipped there in January last, while during the seven months' period the number was 442 and the value $269,437.

Italy bought nineteen American cars in January last, the value being $24,173. During the seven months' period the number was 184 and the value $127,586. Only three cars were shipped to Italy during January a year ago, the value being $2,412. During the seven months' period the number was twenty-six and the value $23,722.

The shipments to "all other European countries" amounted to 116 cars, valued at $100,372, in January last, and to 659 cars, valued at $673,928, during the seven months' period. For the corresponding periods of last year the number was 130 cars, valued at $229,065, in January, and during the seven months the number was 701 cars, valued at $1,894,278.

Increase in Canadian Imports

During January last 862 cars, valued at $581,563, were exported to Canada, while during the seven months' period the number exported was 3340, valued at $2,440,316. This is a big increase over the shipments for the same periods of last year, when 263 cars, valued at $226,533, were shipped in January, while for the seven months' period the number was 1378 and the value $1,890,693.

The number of cars shipped to Mexico in January last was thirty-nine, valued at $42,154, as against three, valued at $1,410, exported there in January a year ago. During the seven months' period the number increased from thirty-nine, valued at $48,427, in 1915, to 169, valued at $168,316, in 1916.

The West Indies and Bermuda continue to loom up large in the export tables, 266 cars, valued at $187,339, being shipped there in January last, as against 102 cars, valued at $66,980, exported in January a year ago. During the seven months' period the shipments increased from 468 cars, valued at $341,012, in 1915, to 2170 cars, valued at $1,345,896, in 1915.

Heretofore shipments of cars to South American countries have been grouped under the general head South America. In January a year ago the number of cars exported there was 104, valued at $54,276, while during the seven months' period the number was 471, valued at $270,685. The growing importance of this trade is seen in the following fig-

Exports of Automobiles, Trucks and Parts for January and Seven Previous Months

	January				Seven months ending January			
	1915		1916		1915		1916	
	Number	Value	Number	Value	Number	Value	Number	Value
Commercial	935	$2,545,527	1,269	$3,416,818	3,972	$10,989,442	12,391	$32,559,354
Passenger	1,803	1,313,153	4,520	3,044,995	6,904	5,808,099	27,376	21,471,078
Total	2,738	$3,858,680	5,789	$6,461,813	10,876	$16,797,541	39,767	$54,030,432
Parts (not including engines and tires)	.....	615,185	.....	1,800,621	.....	2,789,246	.....	12,791,951
Total	.....	$4,473,865	.....	$8,262,434	.....	$19,586,787	.....	$66,822,383
BY COUNTRIES								
Denmark	.....	.....	105	$80,687	.....	.....	442	$296,437
France	236	$527,869	521	1,358,115	2,024	$5,017,488	3,172	7,993,295
Germany	.....	.....	.....	.....	16	17,364	.....	.....
Italy	3	2,412	19	24,173	26	23,722	184	127,586
Russia	.....	.....	151	338,324	.....	.....	3,261	12,824,047
United Kingdom	1,389	1,770,966	1,090	1,718,886	3,448	4,758,702	13,571	18,614,667
Other Europe	130	229,065	116	100,372	701	1,894,278	659	673,928
Canada	263	226,533	862	581,563	1,378	1,890,693	3,340	2,440,316
Mexico	3	1,410	39	42,154	39	48,427	169	168,316
West Indies and Bermuda	102	66,980	266	187,339	468	341,012	2,170	1,345,896
South America	104	54,276	.....	.....	471	270,685	.....	.....
Argentina	.....	.....	576	245,376	.....	.....	2,555	985,515
Brazil	.....	.....	24	15,069	.....	.....	110	66,056
Chile	.....	.....	69	40,935	.....	.....	486	338,094
Venezuela	.....	.....	30	18,452	.....	.....	277	184,175
Other South America	.....	.....	44	25,290	.....	.....	254	146,834
British East Indies	.....	.....	399	286,872	.....	.....	1,629	1,230,243
British Oceania	155	124,751	576	441,306	1,354	1,084,885	3,407	2,806,256
Asia and other Oceania	293	808,793	551	685,391	683	1,246,244	1,727	2,370,204
Other Countries	60	45,625	351	271,509	268	204,041	2,354	1,418,547
Total	2,738	$3,858,680	5,789	$6,461,813	10,876	$16,797,541	$39,767	$54,030,432

ures: Argentina, 576 cars, valued at $245,376, in January last, and 2555 cars, valued at $985,535, during the seven months' period; Brazil, twenty-four cars, valued at $15,069, in January, and 110 cars, valued at $66,056, during the seven months; Chile, sixty-nine cars, valued at $40,935, in January, and 486 cars, valued at $338,094, during the seven months; Venezuela, thirty cars, valued at $18,452, in January, and 277 cars, valued at $184,175, during the seven months; other South American countries, forty-four cars, valued at $25,290, in January, and 254 cars, valued at $146,834, during the seven months.

British East Indies took 399 cars, valued at $286,872, during January last, and 1629 cars, valued at $1,230,243, during the seven months' period. Shipments to British Oceania during January last amounted to 576 cars, valued at $441,306, while during the seven months' period the number was 3407, valued at $2,806,256. During these same periods the shipments to other Asia and Oceania numbered 551 cars, valued at $685,391, in January, and 1727 cars, valued at $2,370,204, during the seven months.

Shipments to all other countries amounted to 351 cars, valued at $271,509, in January, and to 2354 cars, valued at $1,418,547, during the seven months' period.

The table opposite shows the exports in detail.

—

Shuler Axle Incorporated

DETROIT, March 16—The Shuler Axle Mfg. Co. has been incorporated, with a capital stock of $100,000, to make automobile axles. Temporary manufacturing quarters have been secured in the premises of the West Side Fuel & Supply Co., Dragoon Avenue and the Wabash Railroad.

Frank A. Shuler, who is president and general manager of the new concern, started with the Timken-Detroit Axle Co. several years ago. Later he joined the Metal Products Co., became production superintendent, and after four years again joined the Timken organization, becoming master mechanic and assistant superintendent.

The other incorporators and officials of the new company are J. J. Kern, secretary-treasurer, and who is connected with the West Side Fuel & Supply Co., and R. H. Dewey, who is vice-president.

—

Butler Co. to Move to Indianapolis

KNIGHTSTOWN, IND., March 17—To better its shipping facilities and service the Butler Mfg. Co., this city, will move its plant to Indianapolis. This company will devote its time to the manufacture of three types of pistons, cylinder regrinding and special machine-shop work.

Freight Car Situation Still Serious

—

Detroit Manufacturers See Need for Use of Convertible Flats for Months Ahead

DETROIT, March 20—With hardly any exception local automobile manufacturers say that the railroad freight car situation is no better to-day than what it was a month ago. Several traffic department officials claim that it is even worse, while a few others say there has been a slight improvement.

All who were seen on the subject agree that the railroads are trying their best to remedy the conditions, but that the roads are practically powerless to overcome conditions which they do not and cannot control.

In the first place there is the weather. There have been so many storms in the East this winter, and when a road had partially cleared its tracks and started to move its long line of waiting freight cars, a new storm, more violent than the preceding one, again tied up the whole system.

Cars Tied Up in East

The second reason why there is so little relief is the fact that thousands of cars loaded with freight are tied up, in the East, and cannot be released. This applies to almost all the roads to New York and New England.

It is not alone the automobile industry which is greatly hampered in the moving of its products. The condition is general in all industries. The railroads receive as many complaints from steel manufacturers, from ammunition makers, from furniture makers, etc., as from automobile manufacturers.

One of the big railroad freight traffic managers stated that no one is to blame because no one, either manufacturer or railroad, has foreseen that such a condition would arise. Had the roads been advised by the automobile manufacturers that their production will be double in 1916, then they would not have hesitated to take steps for additional automobile equipment. As it is the manufacturers, with a few exceptions, have not and do not post the railroads.

Cannot Get New Cars

The Michigan Central railroad ordered 4500 special 40-ft. automobile freight cars in September. Up to date only about 225 have been delivered. The delay is caused owing to the shortage of material.

The Packard and Chalmers companies say that there has been practically no improvement in the freight car situation. Both concerns had to put on about seventy-five extra men who are used in making improvised boxes, or wooden coverings, over the automobiles when the latter are on the flat cars. Dodge Brothers say they are short at least 40 per cent of the number of railroad cars they need daily. The Hupp Company cannot get enough flat cars and these come in irregularly and in very small number. Cadillac finds conditions somewhat better as far as shipping West is concerned, but no improvement in the East. Paige-Detroit says the conditions are a little better. Studebaker has found hardly any betterment. All of these concerns had to put on extra help either in making wooden housings on the flat cars or to take care of other special work which, under normal conditions, would not be necessary, which means a big additional expense in shipping, but they are content to get whatever cars they can.

The Detroit Board of Commerce has decided to open a special freight traffic school, under the direction of Traffic Commissioner Arthur T. Waterfall, from March 21 to May 23.

Traffic and operating officials from the different railroads will, from time to time, be present at the lessons, and will explain various different subjects, concerning their respective departments.

That the school is expected to bring about good results and that it will be well attended is the opinion of Mr. Waterfall.

—

Studebaker Boosts Output

DETROIT, March 20—Additions to the Studebaker Corp. plant here, involving an expenditure of $1,000,000 for buildings and equipment, are now practically completed. It means that production will soon be increased to at least 400 cars a day, instead of 300 as now, and that this year's output will probably be 100,000 cars.

Extensions to the plant consist of a new building for the manufacturing of heavy forgings, such as six-throw crank shafts and front axles; a three-story warehouse, 52 by 335 ft., with accommodations for 150 carloads of raw material; a three-story addition to the main manufacturing plant, adding 35,000 sq. ft., of floor space, to be used for wheel, chassis, painting and assembly; seven large double chambered furnaces to replace smaller types in the heat treating and carbonizing departments; seven forging machines for making gear blanks are being added, also two additional 500-hp. water tube boilers; a 2000-hp. low pressure turbine generator is being added to be operated by exhaust steam available from the forge plant. In the manufacturing machinery department seventy-five pieces of equipment are also being added to take care of six-cylinder engine parts.

Detroit Section of the S. A. E. Discusses Rear Axle Design

J. G. Perrin's Paper Provokes Lively Discussion—Transmission Brakes and Truck Axles Without Differentials Are Leading Subjects

DETROIT, MICH., March 17—Before the usual large crowd that overflowed the convention hall of the Pontchartrain Hotel, J. G. Perrin, chief engineer, Timken-Detroit Axle Co., read a paper on the Evolution of the Rear Axle, and provoked a spirited discussion of a topic that is of utmost importance to-day. Much interest was displayed in the hints that before long we may have cars without differentials, as experiments are now being conducted along this line.

Previous to the reading of the paper of the evening, a constitution, by-laws and rules were adopted by the Detroit Section. The offering of these for adoption was the occasion of a rather spirited discussion in some quarters.

Up to this time the Section has operated with no constitution and by-laws other than those of the national S. A. E., and the action simply puts the Section upon a firmer business basis.

Perrin's paper began with an historical sketch of rear axle development and considered some of the more prominent constructions of the day. Mostly it will be valuable for purposes of record and is a useful reference for engineers who are contemplating the design of a new axle. Toward the end the following statement was made regarding materials suitable for use in rear axle construction.

Materials Use in Rear Axles

Malleable iron is used in differential housings in the carrier units that hold the pinion-shaft and differential bearings, brake spiders and some of the hubs. This material has the following average physical properties:

Maximum strength...43,790 lb. per sq. in.
Elastic limit.....30,540 lb. per sq. in.

Drive-shafts are made from chrome nickel steel with these physical properties.

Maximum strength..145,000 lb. per sq. in.
Elastic limit.....120,000 lb. per sq. in.
Elongation in 2 in... 15 per cent
Reduction in area... 52 per cent

This material in a shaft of 1 5/16-in. diameter, the size used in large production, when subjected to torsion shows the following ability:

Torsional moment
Maximum strength..54,000 lb.-in.
Elastic limit.....33,000 lb.-in.
Angle of twist..... 1,300 deg.
Fiber stress.....74,600 lb. per sq. in.

The sleeve used in the full-floating type of axle is made of either carbon or chrome nickel steel, according to the size and load capacity of axle. The chrome nickel steel shows the following physical properties:

Maximum strength..105,500 lb. per sq. in.
Elastic limit..... 81,000 lb. per sq. in.
Elongation in 2 in.. 25 per cent
Reduction in area... 66 per cent

The bevel gear and pinion have to be of a steel of high physical properties with a hard wearing surface and tough inner core. This necessitates the use of a case-hardening low-carbon steel alloyed with chromium and nickel. The core shows the following average physical properties:

Maximum strength..107,000 lb. per sq. in.
Elastic limit..... 60,000 lb. per sq. in.

Everybody who has had the experience in testing case hardened specimens, knows that it is very difficult to get uniform tests. We know that we get certain results, but the physical tests of case hardened pieces generally are very unsatisfactory, and they vary a great deal, so that we have to judge of the results we are getting by other than the actual physical tests of the case hardened specimens.

Discussion Lively

Chairman George W. Dunham, in opening the discussion, called attention to the great variety of stresses to which the rear axle is subjected, and said that after analyzing them you wonder that the unit stands up at all. It carries the torque, transmits the power, and also has to do the work of propelling the vehicle, which is in another direction, and is subject to side strains as the car skids or drops into ruts or sudden obstructions. And it is doing its work right down in the dirt and mud all the time. A great many axles to-day, he commented, are still subject to oil leakage trouble.

McCall White Expects Development

D. McCall White, Engineer for the Cadillac Company, read a very interesting commentary on the paper. It is given in part below:

We have to-day reached great heights of development in engine design, and I think that now is the time for engineers to turn their fertile brains to the development, and further refinements in other portions of the chassis, notable among which is the rear axle.

Mr. Perrin has mentioned that the stamped steel type of axle is probably the most universally used type of any form of axle construction, as regards number of car makers who have adopted it.

I would like to ask Mr. Perrin, if the reason for the almost wholesale adoption of this type is not rather, because of the quantities which are being turned out by his company, than the fact that it is the best type of axle design having the maximum strength for the minimum weight.

The banjo casing or pressed steel housing is, as Mr. Perrin describes, made from carbon steel which has an elastic limit of 34,000 lb. per square inch, and therefore, cannot be stressed above 7000 lb. per square inch without disastrous effect.

The approximate greatest stress in a floating axle is near the spring seat, and is caused by the combined cantilever loads from the weight of the car, the tractive effort, and torque reaction.

The diameter of the casing here cannot be very great, so the tubular portion of the casing must either be somewhat thick to withstand the stress or an inserted tube made from alloy steel must be used.

This inner alloy steel tube must in its turn be carried in, and adequately supported, towards the center of the casing, so that we really have a comparatively heavy construction.

British Design

This particular design of the banjo casing originated, if I remember correctly, in England, at the plant of the Daimler Motor Car Company, around the year 1905-1906, and has since, as Mr. Perrin states, been largely used in this country.

In view of the large size of that part of the casing which surrounds the bevel gears, the stress is extremely low, with the result that a thin casing could reasonably be employed were it not for the fact that it would not be a manufacturing possibility to weld the halves of the casing together satisfactorily, if they were less in thickness than about 5/32 in.

This then, forces us to arrive at the fact that, were the axle scientifically designed, without manufacturing prohibitions, we could have a pressing of varying thickness made from alloy steel to suit the moduli of the sections employed, and the stresses which come upon those sections.

The different forces which rear axles require to resist are of a most complex form, varying from minimum to maximum with the greatest frequency, and it behooves us, in view of the fact that this part is unsprung weight, to exert as much ingenuity as we possibly can, to make this important assembly as light as possible, combined with rigidity.

Engineers who have been seeking the greatest reduction of weight in rear axle design, are, I think, rather inclined towards swaged alloy steel tubings, flanged and bolted to an aluminum center piece or differential casing.

It is a matter of considerable doubt as to whether an axle designed on those lines will be able to withstand the continuous vibrations, caused by the pounding on rough roads even though it be supported by a tie rod of sufficient strength, although, I understand that one prominent manufacturing company originally used an aluminum center piece with success, and upon the price of the commodity going beyond the reach of its purse reverted to malleable iron or steel castings, and was confronted with the problem of the axles breaking, due evidently to the increased weight pounding on the rough roads.

On the other hand, I have an authentic statement that another company found that the aluminum center went to pieces due to fatigue after a given mileage, which I understand extended possibly over two years.

It may have been that this latter casing was stressed too highly although history does not say so.

Favors Aluminum Case

Sufficient to say that my experience in Europe leads me to believe that aluminum would be perfectly safe, provided it was not overstressed.

I believe that to-day, considering that we are on the threshold of an era of quieter axles, due to the introduction of spiral bevels, the need of designing a rear axle, the differential of which can be removed almost as easily as a spark plug, is almost gone, more especially as most of us obligingly mount the gasoline tank behind the axle cover, thus making a difficulty of examination in any case, and we could therefore design a stronger and more rigid aluminum casing if such openings were no longer necessary.

I have in past years been an exponent of worm axle design, and still believe that there is some future before it, believing also, from very extended experience, that a slightly lower gear ratio with a worm than with a bevel is necessary in order to compensate for the very slight difference in mechanical efficiency.

Regarding Mr. Perrin's statement about the De Dion Company's axles, I can say that this company still employs the axle with universally jointed shafts, and the differential casing bolted to the frame, to reduce unsprung weight, on their large heavy cars, where the axle would naturally be considerably heavier than in its light cars where the orthodox design is used.

As regards the bevel pinion, I am of opinion that no fewer teeth than eleven should be used if one wishes a sufficiently strong and quiet construction, and with reference to the mounting of same, I am more partial to the overhung pinion than to the pinion supported on both sides, and although this latter would appear to be more correct, the former has given me the quietest rear axle.

Using materials such as Mr. Perrin suggests, the stress, in my opinion should not exceed on the pinion teeth 22,000 lb. per square inch, and on the axle tubes 13,000 lb. per square inch.

Possibly these stresses may seem high, but one must remember that there are the stresses due to such loads as weight of car, weight of axle itself, reflex engine torque, reflex brake torque, tractive effort, inertia of the axle itself, etc., to be considered.

Brush Dislikes Unsprung Weight

A. P. Brush, Brush Engineering Assn., touched upon the matter of unsprung weight, saying that he is a crank on its elimination as well as in the elimination of other things that prevent the tubes from having only pure torsion.

The possibility of running axles without differentials was dilated upon. Mr. Perrin said that it is being experimented with all over the country. In Europe they are running some of the ambulances without differentials, and they find that the efficiency of the truck is increased a great deal, as regards straight-ahead going. The only limiting factor, so far, has been the short turning radius, as trucks so equipped cannot turn around in such close quarters as conventionally built types, because the friction of the parts is too great. The binding effect in trying to turn around in too short a circle has been too great to be satisfactory on the rough ground. One prominent electrical concern building electric cars, said Mr. Perrin, has tried the non-differential construction out in New York City and found that the ampere draw either with or without differential was practically the same.

F. E. Moskovics, Nordyke & Marmon Co., said that he noticed several concerns are in the habit of making differentials without adjustment, and asked for the comments of the author of the paper on this subject. Mr. Perrin said that the other arrangement that would have to be used, if there were no screw adjustment in the meshing of the bevel gear, is the fitting of variable thicknesses of spacers back of the pinion, back of the main bevel gear. That has been tried, he said, and it is continued to-day in some cases, and while it is perfectly feasible in small productions, it has not proved a commercial possibility in large outputs.

Alex Churchward asked as to the relative efficiency of the spiral bevel, the straight bevel, and worm on passenger car installations, and Mr. Perrin's reply was that neither type has shown enough loss of efficiency to cut any figure. All the figures show that under normal conditions they all run over 95 per cent.

C. C. Hinckley, Engineer Chalmers Company, brought up the questions as to why the grease runs out, why does a brake squeak, etc. Each engineer has a different answer to every question, he said. Hinckley is of the opinion that the biggest development so far in rear axle construction has been the two-pinion differential, believing that it is good for any average practice. He also raised the question as to how to get a big enough ring gear in a car with small wheels, and still have sufficient road clearance.

Regarding this latter point, Mr. Perrin says that you cannot eat your cake and have it too. The thing is a compromise. If you are going to have the power, you must have adequate means of resisting it, and that necessitates teeth of certain sizes. You cannot get away from that, and if you are going to have the ratios, you must have big ring gears. He thought Mr. Hinckley knew as much about brake squeaks as he (Perrin) does.

—

Cleveland S. A. E. Also Discusses Fuel

CLEVELAND, OHIO, March 18—The meeting of the Cleveland Section of the Society of Automobile Engineers, held here last night, was very successful, the attendance totaling 125, of whom ninety-five dined together immediately before the meeting. Mr. Kettering, the speaker of the evening, did not have a prepared paper, but talked concerning the chemistry of combustion with respect to the major problems of carburetion. Dr. Rittman and Mr. Williams of the Government Bureau of Mines contributed to the discussion, repeating some of the information which they gave the previous evening to the Metropolitan Section. Other speakers were President Russell Huff and general manager C. F. Clarkson.

—

Settle Details of Columbia Car

DETROIT, March 18—So far have the plans of the Columbia Motors Co., recently organized in Detroit by some prominent men in the industry, among whom are W. E. Metzger and J. G. Bayerline, been completed that a preliminary idea of the type of car thas is to be manufactured is now given out. Built upon a wheelbase of 115 inches, the new Columbia is a six that should claim a position for itself due to its very pleasing outline and general good looks. The ultra-modern type of body design is used in continuing the hood on exactly the same slope as the rest of the body, using a cowl at the back of the front seat, rounding the front of the body over, and slanting the windshield.

The car will be constructed of standard units with the motor, a 3 by 4¾ block-cast six having a multiple dry-disk and three-speed gearset in unit with it. There will be a two-unit starting and lighting system, the name of which is not yet divulged. Other specifications include Tinkem front and three-quarter floating rear axles, cantilever rear

springs and semi-elliptic front suspension, chrome-nickel steel frame, and Stewart vacuum feed from a tank at the rear. Some of the equipment features are 32 by 3½ tires on demountable rims, crowned fenders and other features that go with the up-to-date vehicle.

Roominess of the body is made one of the features as well as the general body appearance. The back seat measures 46 in. across, outside of the upholstery. Weight is said to be in the neighborhood of 2150 pounds.

—

Hupp Addition Nearly Completed

DETROIT, MICH., March 18—Within a few weeks the second of the two stories which are being added to the plant of the Hupp Motor Car Co. here will be completed. It means that nearly 26,000 sq. ft. of additional manufacturing floor space will be added to the plant and that the working force will be increased by several hundred men. Production will be greatly increased.

—

Silver Has New Sales Plan

NEW YORK, March 17—The C. T. Silver Motor Co., this city, handling Overland, Willys-Knight and Peerless cars, has formed a plan to increase sales by overcoming the present hesitation of buyers on account of the high price of gasoline. This company will furnish gasoline at 25 cents a gallon to retail purchasers from March 20 to Sept. 20. A ticket will be presented to each retail purchaser of a new car entitling him to gasoline at the above price at either of the Silver branches.

—

Paige Makes Record Order

DETROIT, March 18—On the first day of March the Paige-Detroit Motor Car Co. reports that it had orders on hand for 3748 Paige cars, of a total value of about $4,000,000. Orders from dealers are coming in at such a rate that the Paige company does not believe it will be able to make as many cars as its distributers request. Compared with the business done last year in February, the past month was several hundred per cent better.

M. & S. Capital Now $1,750,000

—

Increased $750,000 — Amount All Subscribed for by Stockholders

DETROIT, MICH., March 18—The capital stock of the M. & S. Gear Co., manufacturer of the M. & S. differentials, has been increased from $1,000,000 to $1,750,000 and the issue of $250,000 of preferred stock was authorized. This amount was all subscribed for by the stockholders.

The following officers have been elected: Lewis H. Scurlock, continuing as president and general manager; W. H. Kirn and Wm. H. Hill, vice-presidents; W. H. Holden, secretary and treasurer; and C. C. Wolf, Parkersburg, Ia., and O. W. Smith, New York City, directors.

The M. & S. company is now manufacturing its new design which is an improvement over that previously used in that it does not employ a spider for holding the gears. These improvements have greatly reduced the cost of manufacture.

The business of the company has greatly increased during the last six months, and steps were taken some time ago for increasing the output. The Detroit plant on Lycaste Street has been in course of enlargement and will be ready by June 1, when the daily production here will average 200 differentials or more. Officials say that orders on the books now will keep the plant running to its full capacity for many months.

—

Steel Reaches Record Prices

NEW YORK CITY, March 21—A continuation this week of record-breaking prices in the steel market has been the cause of many inquiries as to how high the market will go. Prices now on Bessemer and open-hearth steel are double those of 1914. Last week both grades of steel jumped $5 per ton to $45. Another metal which is quoting now high, is lead. Prices on this metal are now at double what they were a year ago. This week lead jumped to $8 per 100 lb., the highest it has reached. Beams and channels rose to $2.62 per 100 lb. at a gain of 20 cents.

Pennsylvania crude oil supplemented the rise of the metals by going up to $2.60 a barrel. This high price has been equalled only once before, that being in 1895, when it was maintained for only 24 hr. On that occasion it reacted to $2.40, but there is no such movement in prospect now, according to leading oil interests. Failure of repeated advances through the last several months to increase the supplies of crude available for refiners is given as the cause for the advance. Refiners, however, expect to replenish their tanks, from the oil held in storage, and which they felt was being held by producers for $2.50. They now feel that little short of $3 a barrel will move this reserve.

There was no material change in the rubber situation last week, though trading was a little more active. Prices held steady with Ceylon first latex, a little lower. Para rubber went down to 74 cents a pound on Thursday, but picked up gradually again to 76 cents.

—

Detroit Axle Capital Stock Increased to $150,000

DETROIT, MICH., March 18—The capital stock of the Detroit Axle Co. has been increased from $50,000 to $150,000. This concern, which started here only a few years ago, has been growing steadily. Its business thus far this year has been several hundred per cent better than last year's.

—

Jacobson Machine Gets Saxon Order

WARREN, PA., March 17—The Jacobson Machine Mfg. Co., this city, has received a half-million-dollar order from the Saxon Motor Co., Detroit. It is for 7500 rear axles and transmission gears.

—

Another Overland Building for St. Paul

ST. PAUL, MINN., March 17—A new $700,000 plant is to be erected in St. Paul by the Willys-Overland Co. It will be built west of the Overland assembling plant at Eustis Street and University Avenue, in the Midway district.

The present building is being used to capacity. The structure which will be duplicated has ground dimensions of 200 x 500 ft., and is four stories.

—

J. I. Case Earnings Larger

RACINE, WIS., March 18—The annual report of the J. I. Case T. M. Co., Racine, Wis., just issued, shows that while gross sales fell somewhat below those of 1914 the earnings are very much higher. The gross sales of 1915 were, with one exception, the largest of any year since the company was established in 1842, and

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum	.65	.65	.65	.65	.65	.65	...
Antimony	.44	.44	.43½	.43½	.43½	.43½	— ½
Beams and Channels, 100 lb.	2.42	2.42	2.62	2.62	2.62	2.62	+ .20
Bessemer Steel, ton	40.00	40.00	45.00	45.00	45.00	45.00	+5.00
Copper, Elec., lb.	.27½	.28½	.28½	.28½	.28½	.28½	+ .01
Copper, Lake, lb.	.27½	.27½	.28½	.28½	.28½	.28½	+ .01
Cottonseed Oil, bbl.	10.40	10.42	10.49	10.57	10.69	11.00	+ .60
Fish Oil, Menhaden, Brown	.53	.53	.53	.53	.53	.53	...
Gasoline, Auto, bbl.	.24	.24	.24	.24	.24	.24	...
Lard Oil, prime	.95	.95	.95	.95	.95	.95	...
Lead, 100 lb.	7.75	7.75	7.75	8.00	8.00	7.87½	+ .12½
Linseed Oil	.78	.78	.78	.78	.78	.78	...
Open-Hearth Steel, ton	40.00	40.00	45.00	45.00	45.00	45.00	+5.00
Petroleum, bbl., Kansas, crude	1.55	1.55	1.55	1.55	1.55	1.55	...
Petroleum, bbl., Pennsylvania, crude	2.50	2.50	2.50	2.60	2.60	2.60	+ .10
Rapeseed Oil, refined	1.05	1.05	1.05	1.05	1.05	1.05	...
Rubber, Fine Up-River, Para	.76	.76	.74	.75½	.75½	.76	...
Rubber, Ceylon First Latex	.93	.92	.90	.92	.91	.91	— .02
Sulphuric Acid, 60 Baume	2.00	2.00	2.00	2.00	2.00	2.00	...
Tin, 100 lb.	55.00	54.00	52.00	51.00	51.00	50.00	—5.00
Tire Scrap	.06½	.06½	.06½	.06½	.06½	.06½	...

amounted to $14,058,631. Earnings for 1915 were $1,931,824, compared with $966,697 in 1914. After paying $850,000 in preferred dividends and making an appropriation of an additional $500,000 for contingent losses, the earnings were equal to 7 per cent on the $8,300,000 outstanding common stock. The preferred stock outstanding is $12,150,000. The company during 1915 liquidated $1,000,000 more of the $12,000,000 bond issue of Feb. 1, 1914, and thus far has redeemed $2,500,000, leaving $9,500,000 outstanding. This is to be taken care of by three annual payments of $500,000 in 1916, 1917 and 1918, followed by eight annual payments of $1,000,000. The record of gross sales for the last four years is as follows: 1912, $14,026,633; 1913, $13,417,405; 1914, $14,395,384; 1915, $14,058,631.

—

New Prest-O-Lite Battery Plant Nearly Completed

INDIANAPOLIS, IND., March 17—The large addition to the main factory of the Prest-O-Lite Co., this city, to increase the production of its storage batteries is practically completed. The building is 400 x 100 ft., one story, and adds 40,000 sq. ft. The construction is reinforced concrete.

The present output of 400 batteries a day will be increased to 1200 as soon as the addition is completed.

—

White Declares Initial Dividend of 1¾ per Cent

CLEVELAND, OHIO, March 18—The White Motor Co. has declared an initial dividend of 1¾ per cent, payable April 8 to holders of record March 25.

In connection with the initial dividend of 1¾ per cent on the $16,000,000 stock, it is stated that the stock has been placed on a regular 7 per cent per annum basis.

—

Dividends Declared

Kelly-Springfield Tire Co.; quarterly of 1½ per cent on 6 per cent preferred.

Automobile Securities Active

—

Chevrolet Reaches New High Mark of 160—General Motors Rises 15 Points

NEW YORK CITY, March 21—The automobile securities last week were featured by sharp gains ranging from 1 to 15 points. Following quite a protracted period of reaction, another boom is on in Wall Street. Not in months has there been such a display of activity and strength as was witnessed on the Stock Exchange this week. Those who held onto their automobile shares during the reaction will find gratifying gains for this week. Especially in Chevrolet and General Motors issues, will those who held for a turn for higher quotations be rewarded for their patience. Last week both Chevrolet and General Motors saw a sharp rise of 13 and 15 points, respectively. Chevrolet reached a new high mark of 167 on Wednesday, an advance of 30 points within two weeks. At times the demand for the stock was such that offerings had to be made by controlling financial interests to prevent a runaway market.

The week's development included a revival of the proposition by certain interests in General Motors management for the creation of a stock voting trust. The new circular, which had thirteen signers owning 8047 shares, or 2½ per cent of the total outstanding stock, urged the voting trust for the protection of the stockholders. The attempt to create a voting trust in that company's stock does not seem likely to succeed. W. C. Durant and his associates, against whom the voting trust is aimed, own 162,437 shares of General Motors stock out of a total of 316,000, or 51 per cent. Of this holding 104,000 shares are of common stock, and the balance preferred. The Durant interests, it is stated, have refused offers of additional shares and have officially announced that no more stock would be accepted under the terms of the original offer of exchange.

Studebaker, Maxwell and Overland issues were strong at the closing on Saturday. Maxwell common went up 12½ points to 72½ points; its second preferred rose 2 points to 85; and the first preferred rose 1 point to 46½. Studebaker common closed at 146, a gain of 6 points. Willys-Overland common, after a gain of 12 points during the previous week, again rose, reaching 234, just 6 points higher. Paige-Detroit stock was strong at 690, just 15 points higher than last week.

Tire issues within the past two weeks have shown strength with substantial gains. Last week Ajax rose 3 points; Goodrich common went up 2 points as did that of Goodyear; Kelly-Springfield's new common rose 5¼ points to 74¼, and U. S. Rubber common closed at 53½, a gain of 2 points.

Chalmers Show Rise

Saturday, which is generally an off day on the Detroit Stock Exchange, was a very lively day. The cause was the demand for Reo Motor Truck Co.'s shares and for Chalmers shares. The former, which was quoted at 25¾ and 27 on Friday, was at 28½ bid and 29½ asked at the close of the exchange to-day. Rumors that the company may declare an extra dividend soon and that its business was exceptionally good, have been going around the brokers' offices all week. The big business of the Chalmers company is also said to be the reason for this stock making a gain of 6 points. Demand continues to be steady for Continental Motor stock. From Muskegon comes the report that Detroit brokers are asking owners of the stock there for 30-day options at $40 a share, which is $5 higher than the stock quotes now, and also offer $1 a share to bind the option. Although much of the stock is held by Muskegon people very little is being offered for sale.

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915 Bid	1915 Asked	1916 Bid	1916 Asked	Wk's Ch'ge
Ajax Rubber Co. (new)	..	..	70	71	+3
Aluminum Castings pfd	98	100	..	..	..
J. I. Case pfd	78	82	85	87½	+1
Chalmers Motor Co. com	..	82	150	170	+10
Chalmers Motor Co. pfd	91½	93	98½	100	..
Chevrolet Motor Co	..	..	160	162	+13
Electric Storage Battery Co	49	50	63½	66	+ ½
Firestone Tire & Rubber Co. com	400	403	745	755	..
Firestone Tire & Rubber Co. pfd	108	109½	113	115	..
General Motors Co. com	95	96½	480	485	+15
General Motors Co. pfd	96	96¾	113½	114	+ ¾
B. F. Goodrich Co. com	34	35	74½	75½	+2
B. F. Goodrich Co. pfd	98½	100½	116	117	..
Goodyear Tire & Rubber Co. com	192	194	340	344	+2
Goodyear Tire & Rubber Co. pfd	104½	105½	115	117	..
Gray & Davis, Inc., pfd	..	..	..	..	..
International Motor Co. com	..	..	22	25	+3
International Motor Co. pfd	..	..	35	40	+3
Kelly-Springfield Tire Co. (com)	111	112	..	..	..
Kelly-Springfield Tire Co. (com. new)	..	..	74¼	75	+5¼
Kelly-Springfield Tire Co. 1st pfd	83	85	96	97	+1
Kelly-Springfield Tire Co. 2d pfd	118	125	..	..	..
Maxwell Motor Co. com	30⅜	31¼	72½	73¼	+12½
Maxwell Motor Co. 1st pfd	73⅛	73½	85	87	+2
Maxwell Motor Co. 2d pfd	30¼	30½	46½	47½	+1
Miller Rubber Co. com	163	170	235	250	..
Miller Rubber Co. pfd	101	103	112	115	..
New Departure Mfg. Co. com	128	130	172	175	..
New Departure Mfg. Co. pfd	105	108	111	..	..
Packard Motor Car Co. com	..	97½	165	175	—5
Packard Motor Car Co. pfd	93½	97½	102	104	..
Paige Detroit Motor Car Co	..	..	690	715	+15
Peerless Motor & Truck Corp	..	..	27⅛	27½	+ ⅝
Portage Rubber Co. com	34	36	70	75	..
Portage Rubber Co. pfd	85	95	106	108	..
Regal Motor Co. pfd	..	..	..	..	..
*Reo Motor Truck Co	11½	12½	26½	28½	+2½
*Reo Motor Car Co	28½	29¼	33	34	..
Splitdorf Electric Co. pfd	..	..	..	..	..
Stewart-Warner Speed. Corp. com	54½	56	88	90	+1½
Stewart-Warner Speed. Corp. pfd	101½	..	108½	..	..
Studebaker Corp. com	47	47¾	146	148	+6
Studebaker Corp. pfd	93	95	112	114	—1
Swinehart Tire & Rubber Co	73	75	87	90	—1
Texas Co.	132	133	201½	204½	+10
U. S. Rubber Co. com	55½	56½	53½	53¾	+2
U. S. Rubber Co. pfd	102½	103	109¼	110	+1¾
Vacuum Oil Co	180	181	224	228	+4
White Motor Co. (new)	..	..	..	..	..
Willys-Overland Co. com	115	116	234	235	+6
Willys-Overland Co. pfd	100	101	105½	106	+1½

*Par value $10.

The Week in the Industry

Murray Duplex Power Secretary—Fred Murray has been appointed secretary of the Duplex Power Car Co., Charlotte, Mich., succeeding the late M. J. Lampson.

Biggam Detroit Trailer Sales Mgr.—H. F. Biggam has been appointed sales manager of the Detroit Trailer Co. He was formerly with the Troy Wagon Works, Troy, Ohio.

Scothorn Joins Steel Products—R. J. Scothorn, formerly manager of the Detroit office of the Columbus Bolt Works, has joined the sales department of the Detroit Steel Products Co., Cleveland, Ohio.

Baily Body Adds—The Baily Mfg. Co. North Wales, Pa., which manufactures automobile bodies, is extending its plant to more than double its present capacity.

Baumbach Appointed Manager—W. L. Baumbach, secretary and treasurer of the Badger Tire Repair Co., 454 Jackson Street, Milwaukee, State agent for the Kelly-Springfield tires, has taken active charge of the business as general manager.

Los Angeles Cole Changes Hands—The Cole Motor Car Co., Los Angeles, Cal., which has been operated as a factory branch under the management of Ed. F. Harris, has been taken over by J. L. Irving, who has been distributer of the Enger in southern California and Arizona for the past year. The Irving Motor Car Co. is now distributer of both lines, and Ed. F. Harris has been appointed sales manager by the head of the concern, Mr. Irving.

Motor Men in New Roles

Morehouse Joins H. A. L.—J. C. Morehouse who during the past two years was a traveling representative of the Maxwell Motor Co. has been appointed sales manager of the H. A. Lozier Co., Cleveland, Ohio, which makes the H. A. L. twelve.

Bayless Joins Champion Plug Co.—B. H. Bayless, formerly in charge of the advertising department of Berdan & Co., Toledo, Ohio, has joined the advertising department of the Champion Spark Plug Co., Toledo, Ohio, where he will assist H. L. Corey, advertising manager.

Wheeler Bowser Advertising Manager—C. D. Wheeler of Philadelphia is to be advertising manager of S. F. Bowser & Co., tank and pump manufacturers, Fort Wayne, Ind., to succeed G. A. Townsend, who resigned a short time ago. Mr. Wheeler for a number of years was advertising manager of the Fort Wayne Electric works; later he accepted a responsible position with the Santo Vacuum Cleaner Co., Philadelphia, where he has since resided.

Niblette Forms Tire Co.—The Niblette Rubber Co. has been organized, with H. B. Niblette at its head, to handle the products of the Rubber Products Co., Barberton, Ohio, manufacturer of Stronghold tires. The Niblette Company will be located at 1777 Broadway and will open for business immediately. Mr. Niblette severed his connection with the Goodrich Rubber Co. Jan. 1. For 5½ years he served as manager of the Goodrich branch at Buffalo, and for 11½ years previous to his Buffalo connection, he was connected with the New York branch of the same company.

Maus Joins Fisk Staff—J. B. Maus, for the last two years Eastern district manager of the Batavia Rubber Co., has joined the Fisk Rubber Co. of New York, where he will have charge of the export department at the general offices in Chicopee Falls, Mass.

Mr. Maus has been in the tire business for ten years.

The Automobile Calendar

March 18-25	Pittsburgh, Pa., Twelfth Annual Show, Automobile Dealers' Assn., Motor Square Garden.
March 25	San Diego, Cal., 50-Mile Automobile Track Race at Fair Grounds.
March 21-25	Deadwood, S. D., Show, Auditorium, Deadwood Business Club.
March 22-25	Lexington, Ky., Show, Woodland Auditorium.
March 25-April 1	Wheeling, W. Va., Show, Market Auditorium.
March 27-April 1	Danville, Ill., Show, Eastern Illinois Dealers.
March 27-April 1	Johnstown, Pa., Show, Auditorium; Johnstown Auto Show Promoters. A. E. Oldham, manager.
March 27-April 1	Zanesville, Ohio, First Annual Southeastern Show, Airdome.
March 28-April 3	Manchester, N. H., Show, Under Auspices Couture Bros. Academy.
April 1-8	Butte, Mont., Home Industry Electric & Auto Show, Holland Arena, H. W. West, Mgr.
April 3-8	Twin Falls, Idaho, Show, Oliver Tabernacle, B. H. Fuller, Mgr.
April 8	Corona, Cal., Race, Citrus Belt Racing Assn.
April 10-15	Seattle, Wash., Show, Arena.
April 12-15	Champaign, Ill., Show, Gymnasium Bldg., University, Ill.
April 14-16	Milwaukee, Wis., Garage-Circuit Exposition, Milwaukee Automobile Dealers.
April 15	Altoona, Pa., Pennsylvania State Motor Federation.
April 26-May 6	Oakland, Cal., First Annual Pacific Coast Motor Power & Automobile Show, Automobile Industries Assn.
May 6	Sioux City, Ia., Speedway Race, Sioux City Speedway Assn.
May 9-12	Hot Springs, Va., N. A. A. A. J. Meeting, The Homestead.
May 13	New York City, Sheepshead Bay Speedway Race. Metropolitan Trophy, 150 miles; Queens Cup, 50 miles; Coney Island Cup, 20 miles, and Brooklyn handicap for non-winners, 10 miles.
May 20	Chicago Non-Professional Speedway Race, Western Interclub Speedway Park.
May 26-27	Del Monte, Cal., Meeting, Three Divisions of National Assn. of Automobile Accessory Jobbers.
May 30	Tacoma, Wash., 100-Mile Speedway Race, Tacoma Speedway Assn.
May 30	Indianapolis Speedway Race.
May 31	Minneapolis, Minn., Speedway Race.
June 10	Chicago Speedway Race. International 300-Mile Race, Speedway Park, Speedway Park Assn.
June 28	Des Moines, Iowa, Speedway Race.
July 2-6	Detroit, Mich., World's Salesmanship Congress, Detroit Board of Commerce Bldg.
July 4	Coeur d'Alene, Idaho, Race Meet, Hilles-Riegel.
July 4	Tacoma, Wash., Speedway Race, Tacoma Speedway Assn.
July 4	Minneapolis 300-Mile Speedway Race.
July 4	Sioux City Speedway Race.
July 15	Omaha, Neb., Speedway Race.
July 15	North Yakima, Wash., Track Race, Riegel-Hiller Co.
Aug. 5	Tacoma Speedway Race, Tacoma Speedway Assn.
Aug. 11-12	Pikes Peak, Colo., Hill Climb, Pikes Peak Auto Highway Co.
Aug. 12	Portland, Ore., Track Race, Riegel-Hiller Co.
Aug. 18-19	Elgin Road Race.
Sept. 4	Des Moines Speedway Race.
Sept. 4	Indianapolis Speedway Race.
Sept. 4-5	Spokane, Wash., Track Race, Inland Auto Assn.
Sept. 11-16	Milwaukee, Wis., Fall Show, Wisconsin State Fair, Milwaukee Automobile Dealers.
Sept. 16	Providence Speedway Race.
Sept. 29	Trenton, N. J., Inter-State Fair. H. P. Murphy, Racing Sec.
Sept. 30	New York City Sheepshead Bay Race.
Oct. 7	Omaha Speedway Race.
Oct. 14	Chicago Speedway Race.
Oct. 19	Indianapolis, Ind., Race, Indianapolis Motor Speedway.